(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 305 093 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
02.07.2014 Bulletin 2014/27

(21) Application number: **10190543.8**

(22) Date of filing: **22.08.2008**

(51) Int Cl.:
A61B 1/008 *(2006.01)* ***A61B 17/29*** *(2006.01)*

(54) Endoscopic surgical devices

Endoskopische chirurgische Vorrichtungen

Dispositifs chirurgicaux endoscopiques

(84) Designated Contracting States:
DE ES FR GB IE IT

(30) Priority: **23.08.2007 US 965857 P**
19.08.2008 US 193864

(43) Date of publication of application:
06.04.2011 Bulletin 2011/14

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
08252797.9 / 2 027 811

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EP 2 305 093 B1

Printed by Jouve, 75001 PARIS (FR)

Description

CROSS-REFERENCE TO RELATED APPLICATION

BACKGROUND

1. Technical Field

[0001] The present disclosure relates to endoscopic surgical devices and, more particularly, to endoscopic surgical graspers and the like capable of a multitude of degrees of operation and/or movement.

2. Background of Related Art

[0002] Endoscopic surgery is surgery performed intracorporeally without requiring a large incision. Endoscopic surgery is typically performed by inserting a number of ports through small incisions in the patient's skin to access the surgical site. One of the ports receives an endoscope, which is a video camera-like device. The surgeon views the surgical site via the endoscope and performs the surgery by inserting various surgical devices through the ports into the patient This avoids having to "open up" the patient, resulting in less invasive surgery than conventional procedures. One such surgical device includes a hand operated endoscopic grasper.

[0003] In an effort to reduce the number of incisions made into the patient, single incision procedures and related surgical devices are being developed. Accordingly, providing surgical devices capable of a multitude of degrees of operation is desirable.

[0004] Accordingly, a need exists for surgical devices including multiple degrees of operation and degrees of motion.

[0005] US 6,666,854 discloses an endoscopic surgical instrument that includes a handle and a control assembly. The control assembly has a spherical crown enclosed by an inwardly extending conical cover defining a conical clearance. The control assembly has a centre and an axis of revolution. Manipulation of the control assembly effects articulation of distal part which contains tool. Articulation of the distal part occurs around Articulation joint. The handle is gripped by one hand of the operator and the control assembly is manipulated with the other hand of the operator.

[0006] US 2005/0273084 discloses articulating mechanisms, link systems, and components thereof, useful for a variety of purposes including the remote manipulation of instruments such as surgical or diagnostic instruments or tools are provided.

[0007] WO 2008/128236 discloses surgical tools and associated methods that offer user control for operating remotely within regions of the body. These tools include a proximally-located actuator for the operation of a distal end effector, as well as additional proximally-located actuators for articulational and rotational movements of the end effector.

SUMMARY

[0008] The present disclosure relates to endoscopic surgical devices, including graspers and the like, capable of a multitude of degrees of operation and/or movement.

[0009] According to an aspect of the present disclosure, an endoscopic surgical device is provided according to claim 1.

[0010] The articulation assembly may include a plurality of joints operatively connected to one another, wherein the plurality of joints includes at least one knuckle permitting articulation in a first transverse direction relative to the longitudinal axis, and at least one knuckle permitting articulation in a second transverse direction relative to the longitudinal axis. The at least one knuckle pennitting articulation in a first direction and the at least one knuckle permitting articulation in a second direction may be oriented substantially orthogonal to one another.

[0011] The handle assembly may include a ball joint configured for radial articulation in any direction around the longitudinal axis, and a plurality of articulation cables each having a first end connected to the ball joint and each having a second end extending through the tube assembly and the articulation assembly and connected to the tool assembly. In use, tilting of the handle assembly about the ball joint, relative to the longitudinal axis, may result in concomitant articulation of the tool assembly.

[0012] At least four evenly spaced articulation cables may be provided around a central axis of the tube assembly In use, as the handle is tilted off-axis, the ball joint exerts a force in a proximal direction on at least one of said plurality of articulation cables resulting in the concomitant articulation of the tool assembly.

[0013] The tool assembly may include a pair of juxtaposed jaws. A distal end of the inner shaft may be operatively connected to the jaws such that a reciprocation of inner shaft relative to the outer tube may result in an opening and closing of the jaws, and a rotation of the inner shaft relative to the outer tube may result in a rotation of the jaws.

[0014] Each jaw may define a cam slot therein. The tool assembly may include a cam pin slidably disposed within each cam slot defined in the jaws. The cam pin may be connected to the inner shaft such that translation of the inner shaft results in translation of the cam pin through the cam slots.

[0015] The handle assembly further includes an actuator connected to the inner shaft In use, actuation of the actuator may result in translation of the inner shaft relative to the outer tube

[0016] The handle assembly may include a keyed member secured to the inner shaft and defining at least one outer longitudinally extending groove, and wherein the collar may include at least one corresponding guide projecting into a respective groove of the keyed member. In use, rotation of the collar may impart rotation to keyed member and the inner shaft and wherein the keyed member and the inner shaft may be axially translatable relative

to the collar.

[0017] The handle assembly includes a spool defining a central lumen therethrough and an off-set lumen for each of said plurality of articulation cables. The spool may define a concave proximale surface configured for engagement with the ball joint. The spool defines a concave annular outer surface.

[0018] The inner shaft may be bendable and may be capable of transmitting rotational forces and axial forces.

DETAILED DESCRIPTION OF THE DRAWINGS

[0019] The present surgical devices will be more fully appreciated as the same becomes better understood from the following detailed description when considered in connection with the following drawings, in which:

FIG. 1A is a perspective view of a handle assembly of an endoscopic surgical device of the present disclosure, shown in a straight or un-articulated position;

FIG. 1B is a perspective view of the handle assembly of FIG 1A, shown in a canted or articulated position;

FIGS. 2A-2C are perspective views of the endoscopic assembly of the endoscopic surgical device of the present disclosure, shown in various angles of articulation;

FIG. 3 is an enlarged view of the distal end of the endoscopic assembly of FIGS. 2A-2C;

FIGS. 4A-4D are illustrations of an articulation joint of the endoscopic assembly of FIGS. 2A-2C;

FIGS. 5A-5D are illustrations of a knuckle of the articulation joint of FIGS. 4A-4D;

FIGS. 6A-6D are illustrations of a first connector of the articulation joint of FIGS. 4A-4D;

FIGS. 7A-7D are illustrations of a second connector of the articulation joint of FIGS. 4A-4D;

FIGS. 8A-8D are illustrations of the handle assembly of FIG. 1;

FIGS. 9A-9D are illustrations of a first half-section of a hub of the handle assembly of FIGS. 8A-8D;

FIGS. 10A-10D are illustrations of a second half-section of the hub of the handle assembly of FIGS. 8A-8D;

FIGS. 11A-11C are illustrations of a spool of the handle assembly of FIGS. 8A-8D;

FIGS. 12A-12D are illustrations of a first half-section of a ball joint of the handle assembly of FIGS. 8A-8D;

FIGS. 13A-13E are illustrations of a second half-section of the ball joint of the handle assembly of FIGS. 8A-8D;

FIGS. 14A-14E are illustrations of a first half-section of a collar of the handle assembly of FIGS. 8A-8D;

FIGS. 15A-15E are illustrations of a second half-section of the collar of the handle assembly of FIGS. 8A-8D;

FIGS. 16A-16D are illustrations of a key member of the handle assembly of FIGS. 8A-8D;

FIGS. 17A-17D are illustrations of a thumb actuator of the handle assembly of FIGS. 8A-8D;

FIGS. 18A-18D are illustrations of a socket joint of the handle assembly of FIGS. 8A-8D;

FIGS. 19A-19F are illustrations of a handle assembly according to an alternate embodiment of the present disclosure;

FIGS. 20A-20J are illustrations of various handle assemblies according to the present disclosure; and

FIGS. 21A-21F are illustrations of various actuators of the present disclosure.

DETAILED DESCRIPTION OF EMBODIMENTS

[0020] Embodiments of surgical devices in accordance with the present disclosure will now be described in detail with reference to the drawing figures wherein like reference numerals identify similar or identical structural elements. As shown in the drawings and described throughout the following description, as is traditional when referring to relative positioning on a surgical instrument, the term "proximal" refers to the end of the device which is closer to the user and the term "distal" refers to the end of the device which is further away from the user.

[0021] Referring initially to FIGS. 1A-3, an endoscopic surgical device is generally designated as 100. Surgical device 100 includes an endoscopic assembly 200 (see FIG. 2A-3) operatively connected to and extending from a handle assembly 300 (see FIGS. 1A and 1B). In general, as seen in FIG. 1, handle assembly 300 maybe configured so as to be held in a hand of an operator in the manner of a syringe or the like and is configured to be operated, if desired, solely with said hand.

[0022] Endoscopic assembly 200 includes a proximal outer tube 210 having a proximal end secured to and extending from handle assembly 300, an articulation assembly 230 supported on and extending from a distal

end of the proximal outer tube 210, and a distal outer tube 220 supported on and extending from a distal end of the articulation assembly 230. Endoscopic assembly 200 further includes an inner shaft (not shown), (e.g., a flexible cable or wire) that is slidably and rotatably supported within and extending through proximal outer tube 210, articulation assembly 230 and distal outer tube 220. A proximal end of inner shaft extends into handle assembly 300 and a distal end of inner shaft extends from a distal end of distal outer tube 220 and is operatively connected to a jaw assembly 250.

[0023] Endoscopic assembly 200 includes an inner tube 250 supported in distal outer tube 220 and configured to surround the inner shaft. A distal end of inner tube 250 defines a clevis which is configured to pivotably support the jaw assembly 260. Jaw assembly 260 includes a pair of jaw members 262, 264 each defining a cam slot (not shown) configured to slidably receive a cam pin (not shown) therethrough. The cam pin is supported on a distal end of the inner shaft and extends from opposite sides thereof to slidably translate in guide slots (not shown) formed in the arms of the clevis. In this manner, as inner shaft is translated relative to inner tube 250, jaw assembly 260 is caused to be open and closed. Jaw members 262, 264 may be configured to grasp tissue and/or cut tissue.

[0024] As seen in FIGS. 2A-2C and 4A-7D, articulation assembly 230 includes at least a pair of joints 232, 234 configured for pivotable movement relative to one another. Each joint 232, 234 includes a respective knuckle 232a, 234a and a respective clevis 232b, 234b formed therewith. Each knuckle operatively engages a clevis of an adjacent joint so as to define a pivot axis. Each joint 232, 234 defines a respective central lumen 232c, 234c formed therethrough for receipt of the inner shaft therein and two-pair of diametrically opposed lumens 232d, 234d formed around central lumen 232c, 234c. Articulation cables 240 are provided and slidably extend through lumens 232c, 234c of joints 232, 234.

[0025] Articulation assembly 230 includes a proximal support joint 236 supported at the distal end of proximal outer tube 210 and defining a clevis 236b configured to pivotably engage a knuckle of joints 232, 234, and a distal support joint 238 supported at a proximal end of distal outer tube 220 and defining a knuckle 238a configured to pivotably engage a clevis of joints 232, 234. Each support joint 236, 238 includes two-pair of diametrically opposed lumens 236d, 238d formed around a central lumen 236c, 238c thereof. Each support joint 236, 238 further includes a stem 236e, 238e for receipt in respective proximal outer tube 210 and distal outer tube 220.

[0026] The knuckles and clevis pair may be alternatingly oriented orthogonal to an adjacent knuckle/clevis pair so as to enable articulation joint 230 to articulate in at least two degrees, i.e., in the plane of the page as seen in FIGS. 2B and 2C, and out of the plane of the page (not shown). It is contemplated that any number of joints 232, 234 may be provided as needed or desired. It is understood that the greater the number of joints provided the greater the degree of articulation of the distal end of endoscopic device 100.

[0027] As seen in FIGS. 1A, 1B and 8A-18D, handle assembly 300 includes a hub 310 operatively connected to a proximal end of proximal outer tube 210, a spool 320 operatively supported on and/or connected to hub 310, a ball joint 330 operatively supported on and/or connected to spool 320, a collar 340 operatively supported on and/or connected to ball joint 330; and an actuator 350 operatively supported in and through collar 340.

[0028] As seen in FIGS. 9A-10E, hub 310 may be formed in a pair of halves 312, 314 which are joined to one another so as to support the proximal end of the proximal outer tube therebetween. When joined together, halves 312, 314 define a lumen 316 therethrough and an annular recess 318 therewithin.

[0029] As seen in FIGS. 1A, 1B and 11A-11C, spool 320 defines a concave outer annular side-wall profile 320a and a lumen 322 extending therethrough. The concavity of the profile of the side-wall may be such so as to accommodate a digit of the hand of the user, such as for example the middle and ring fingers on other side thereof. As seen in FIG. 11C, spool 320 includes a flange 324 extending from a distal surface thereof. Flange 324 is configured and dimensioned for receipt in annular recess 318 of hub 310. In this manner, when halves 312, 314 of hub 310 are joined together, flange 324 is contained within annular recess 318 of hub 310. It is contemplated that annular recess 318 of hub 310 and flange 324 of spool 320 may be dimensioned such that spool 320 is free to rotate relative to hub 310.

[0030] As seen in FIGS. 11A and 11B, a proximal surface of spool 320 may have a concave profile. Additionally, as seen in FIGS. 11A and 11B, spool 320 includes two-pair of diametrically opposed lumens 326 formed around lumen 322 and extending entirely through spoon 320. Lumens 326 are configured to slidably receive articulation cables 240 therein.

[0031] As seen in FIGS. 1A, 1B and 12A-13E, ball joint 330 may be formed in a pair of halves 332a, 332b which are joined to one another define a lumen 332c therethrough. Ball joint 330 defines an arcuate distal surface 334 having a convex profile configured for operative engagement with the concave proximal surface of spool 320. Ball joint 330 further defines an outer annular flange 336 projecting radially outward therefrom. Flange 336 includes two-pair of diametrically opposed apertures 336a formed therearound. Ball joint 330 further includes a connecting hub 338 extending from a proximal surface thereof and defining an annular recess 338a formed therein.

[0032] Endoscopic device 100 includes a plurality of articulation cables 240 each having a first end anchored to flange 336 of ball joint 330 and a second end extending respective lumens 326 formed in spool 320, into lumen 316 of hub 310, through proximal outer tube 210, through respective lumens 232d, 234d formed in joints 232, 234,

and anchored to distal support joint 238 of articulation assembly 230. In operation, as ball joint 330 is pivoted relative to spool 320, articulation cables 240 are either pulled or pushed to effectuate articulation of the distal end of endoscopic assembly 200.

[0033] As seen in FIGS. 1A, 1B and 14A-16D, collar 340 may be formed in a pair of halves 342a, 342b which are joined to one another define a lumen or cavity 342c therethrough. Collar 340 includes a distal flange 344 extending radially into lumen 342c and being configured for receipt in annular recess 338a of connecting hub 338 of ball joint 330. It is contemplated that annular recess 338a of connecting hub 338 of ball joint 330 and distal flange 344 of collar 340 may be dimensioned such that collar 340 is free to rotate relative to ball joint 330.

[0034] As seen in FIGS. 14C and 14E, collar 340 includes a pair of diametrically opposed guides 346 extending into lumen 342c. Guides 346 are configured and dimensioned for slidable receipt in races or slots 348a formed in a key member 348, Key member 348 is slidably disposed within lumen 342c of collar 342.

[0035] As seen in FIGS. 1A, 1B and 17A-17D, actuator 350 may include a loop 352 and a stem 354 extending therefrom. Loop 352 may be configured and dimensioned to receive a digit of the hand of the operator therein, such as, for example, the thumb. Actuator 350 is supported on a proximal end of collar 340 such that stem 354 extends into lumen 342c thereof.

[0036] As seen in FIGS. 18A-18D, handle assembly 300 includes a socket joint 356 having a first end 356a configured for connection to stem 354 of actuator 350, and a second end 356b defining a recess, hollow or socket 356c configured to receive a spherical head or ball (not shown) provided at a proximal end of the inner shaft (not shown) Socket joint 356 and the spherical head at the proximal end of the inner shaft cooperate with one another so as to enable rotation of socket joint 356, and in turn actuator 350, relative to the inner shaft. Additionally, socket joint 356 and the spherical head at the proximal end of the inner shaft cooperate with one another so as to enable axial translation of the inner shaft relative to collar 340, ball joint 330, spool 320, hub 310, and proximal and distal outer tubes 210, 220.

[0037] In operation, with reference to FIGS. 1A-3 and 8A-8D, as actuator 350 is translated relative to collar 340, as indicated by double-headed arrow "A", socket joint 356 transmits said translation to the inner shaft which in turn transmits said translation to the cam pin supported at the distal end thereof, to effectuate opening and/or closing of jaw assembly 260.

[0038] It is contemplated that handle assembly 300 may be provided with a locking or ratchet mechanism configured and adapted to function to maintain the position of actuator 350 as actuator 350 is depressed in a distal direction or towards hub 310. In this manner, jaw assembly 260 may be held in a fixed position, either partially closed or completely closed It is further contemplated that the locking or ratchet mechanism will disengage, thereby allowing actuator 350 to return to an un-depressed position, following complete depression of actuator 350. It is also contemplated that actuator 350 may be biased to the un-depressed position by a suitable biasing element, such as, for example, a compression spring or the like.

[0039] Additionally, in operation, as collar 340 is rotated about the longitudinal axis, as indicated by arrows "B", relative to ball joint 330, spool 320 and actuator 350, collar 340 transmits rotation to key member 348 (see FIGS. 16A-16D). Since key member 348 is fixedly secured to the inner shaft, as collar 340 imparts rotation to key member 348, key member 348 imparts axial rotation to the inner shaft. As the inner shaft is rotated along the longitudinal axis, the inner shaft imparts rotation to the cam pin supported near the distal end thereof, which in turn imparts rotation of jaw assembly 260, as indicated by arrows "B" of FIG. 2A.

[0040] It is contemplated that handle assembly 300 may be provided with a locking or ratchet mechanism configured and adapted to function to maintain the position of collar 340 as collar 340 is rotated relative to ball joint 330, spool 320 and/or hub 310. In this manner, the angular orientation of jaw assembly 260 may be held in a fixed position. It is further contemplated that the locking or ratchet mechanism may be disengaged, thereby allowing collar 340 to freely rotate once again.

[0041] Also, in operation, as ball joint 330 is pivoted at the interface between arcuate distal surface 334 thereof and concave proximal surface of spool 320, in any radial direction relative to the longitudinal axis (i.e., omni-directionally or radially outward in 360° from the longitudinal axis), as exemplarily indicated by arrows "C", articulation cables 240 are pulled and/or pushed to effectuate omni-directional articulation of the distal end of endoscopic assembly 200 in any radial direction relative to the longitudinal axis.

[0042] It is contemplated that handle assembly 300 may be provided with a locking or ratchet mechanism configured and adapted to function to maintain the position of ball joint 330 as ball joint 330 is pivoted off-axis relative to spool 320 and/or hub 310. In this manner, the articulation of jaw assembly 260 may be held in a fixed position. It is further contemplated that the locking or ratchet mechanism may be disengaged, thereby allowing ball joint 330 to return to a centered position and jaw assembly 260 returned to a non-articulated position.

[0043] Turning now to FIGS. 19A-19F, a handle assembly 400 according to another embodiment of the disclosure is shown. Handle assembly 400 is substantially similar to handle assembly 300 and thus will only be discussed in detail herein to the extent necessary to identify differences in construction and/or operation.

[0044] As seen in FIGS. 19A-19F, the handle assembly 400 includes a ring-like collar 440 configured to transmit rotation to the inner shaft (not shown). Additionally, the ring collar 440 is rotatably supported on a central housing 441, wherein the central housing 441 includes a rounded

or arcuate distal end configured for pivotable engagement with the spool via a ball and socket connection 430, as seen in FIG. 19B. It is further contemplated that the actuation cables (not shown) may be anchored, at their proximal ends, to the central housing 441.

[0045] Turning now to FIGS. 20A-20J, various exemplary configurations of respective handle assemblies 400A-400J of the endoscopic device are illustrated. As seen in FIGS. 20A and 20B, respective spools 420A, 420B may extend partially around the handle assembly. It is further contemplated that respective ring collars 440A, 440B may be disposed beneath spools 420A, 420B. As seen in FIG. 20C, respective collar 440C may include tactile enhancing features, such as nubs $440C_1$.

[0046] As seen in FIG. 20D, spool 420D may be formed in a proximal portion $420D_1$ and a distal portion $420D_2$.

[0047] As seen in FIG. 20E, respective collar 440E, articulation assembly 430E, and spool 420F, may be shaped as cylinders and/or rings to provide a geometrically uniform appearance. As seen in FIG. 20F, respective collar 440F may have a more ergonomic contour, and as seen in FIG. 440G, respective collar 440G may have an ergonomic contour having a lower profile as compared to collar 440F shown in FIG. 20F.

[0048] As seen in FIG. 20H, respective collar 440H may have a diameter that is greater than a diameter of respective spool 420H.

[0049] As seen in FIG. 20I, handle assemblies 4001 may be used in cooperation with a guide member 460 for facilitating insertion of the endoscopic assembly (not shown) into the target surgical site.

[0050] As seen in FIG. 20J, respective spool 420J may have a low profile and include only a pair of finger receiving areas $420J_1$ and $420J_2$ formed on opposed sides of handle assembly 400J.

[0051] Turning now to FIGS. 21A-21F, various exemplary configurations of respective actuators 350A-350F of the handle assembly of the endoscopic device are illustrated. As seen in FIG 21A, respective actuator 350A may have a substantially C-shaped cross-sectional profile for facilitating insertion of a finger of a user therein. Actuator 350A may be rigidly connected to inner shaft 220. As seen in FIG. 21D, respective actuator 350D may be pivotally connected to the inner shaft 220. As seen in FIG. 21C, respective actuator 350C may include a pivotally connected strap 352C for surrounding the finger of the user, or as seen in FIG. 21E, respective actuator 350E may include an integrally formed strap 352E.

[0052] It should be understood that the foregoing description is only illustrative of the present disclosure Various alternatives and modifications can be devised by those skilled in the art without departing from the disclosure. Accordingly, the present disclosure is intended to embrace all such alternatives, modifications and variances. The embodiments described with reference to the attached drawing figures are presented only to demonstrate certain examples of the disclosure. Other elements, steps, methods and techniques that are insubstantially different from those described above and/or in the appended claims are also intended to be within the scope of the disclosure.

Claims

1. An endoscopic surgical device (100), comprising:

a handle assembly (300) including a rotation collar (340)

a tube assembly (200) operatively supported on and extending from the handle assembly (300), the tube assembly (200) defining a longitudinal axis and including an outer tube (210) and an inner shaft slidably and rotatably disposed in the outer tube (210);

an articulation assembly (230) operatively supported on and extending from a distal end of the tube assembly (200);

a tool assembly (260) operatively supported on and extending from a distal end of the articulation assembly (230) and connected to a distal end of the inner shaft,

wherein

the rotation collar (340) of the handle assembly (300) is connected to the tool assembly (260) via the inner shaft in such a manner that a rotation of the rotation collar (340) about the longitudinal axis results in a concomitant rotation of the tool assembly (260);

the handle assembly (300) is connected to the tool assembly (260) in such a manner that an actuation of the handle assembly (300) in a particular manner results in a concomitant actuation of the tool assembly (260); and

the handle assembly (300) is connected to the tool assembly (260) in such a manner that a pivoting of the handle assembly (300) in any off-axis direction relative to the longitudinal axis results in a concomitant articulation of the tool assembly (260) via the articulation assembly (230); **characterized in that**

the handle assembly (300) further includes an actuator (350) including a loop (352) and a stem (354) extending therefrom, the actuator being configured for axial translation along the longitudinal axis and connected to the inner shaft,

wherein actuation of the handle assembly (300) results in manipulation of the actuator (350) to result in translation of the inner shaft relative to the outer tube (210) to effect a concomitant transmittal of movement to the tool assembly (260), wherein the movement is one of an opening and closing of the tool assembly (260); and

wherein the handle assembly (300) further includes a spool (320) defining a concave outer annular side-wall profile (320a) and a lumen

(322) extending therethrough.

2. The endoscopic surgical device (100) according to claim 1, wherein the handle assembly (300) includes a ball joint (330), and the handle assembly (300) includes a plurality of articulation cables (240) each having a first end connected to the ball joint (330) and each having a second end slidably extending through the tube assembly (200) and the articulation assembly (230) and being connected to the tool assembly (260), wherein tilting of the handle assembly (300) in any direction about the ball joint (330), relative to the longitudinal axis, results in concomitant articulation of the tool assembly (260).

3. The endoscopic surgical device (100) according to claim 2, wherein at least four evenly spaced articulation cables (240) are provided around a central axis of the tube assembly (200).

4. The endoscopic surgical device (100) according to claim 3, wherein as the handle assembly (300) is tilted off-axis, the ball joint (330) exerts a force in a proximal direction on at least one of said plurality of articulation cables (240) resulting in the concomitant articulation of the tool assembly (260).

5. The endoscopic surgical device (100) according to any one of claims 2 to 4, wherein the articulation assembly (230) includes a plurality of joints (232, 234) operatively connected to one another, wherein the plurality of joints (232, 234) includes at least one knuckle (232a permitting articulation in a first transverse direction relative to the longitudinal axis, and at least one knuckle (234a) permitting articulation in a second transverse direction relative to the longitudinal axis.

6. The endoscopic surgical device (100) according to claim 5, wherein the at least one knuckle (232a) permitting articulation in a first direction and the at least one knuckle (234a) permitting articulation in a second direction are oriented substantially orthogonal to one another.

7. The endoscopic surgical device (100) according to any one of claims 2 to 6, wherein the rotation collar (340) includes a keyed member (348) disposed therein, wherein the rotation collar (340) and the keyed member (348) are connected to one another such that rotation of the rotation collar (340) transmits rotation to the keyed member (348) and such that the keyed member (348) is axially movable relative to the rotation collar (340).

8. The endoscopic surgical device (100) according to claim 7, wherein a proximal end of the inner shaft is connected to the keyed member (348) and a distal end of the inner shaft is connected to the tool assembly (260).

9. The endoscopic surgical device (100) according to claim 8, wherein the keyed member (348) defines at least one outer longitudinally extending groove and wherein the rotation collar (340) includes at least one corresponding guide projecting into a respective groove (348a) of the keyed member (348), wherein rotation of the rotation collar (340) imparts rotation to keyed member (348) and to the inner shaft, and wherein rotation of the inner shaft imparts rotation to the tool assembly (260).

10. The endoscopic surgical device (100) according to any of 2 to 9, wherein the tool assembly (260) includes a pair of juxtaposed jaws (262, 264) operatively connected to a distal end of the inner shaft such that a reciprocation of inner shaft relative to the outer tube (210) results in an opening and closing of the jaws (262, 264), and a rotation of the inner shaft relative to the outer tube (210) results in a rotation of the jaws (262, 264).

11. The endoscopic surgical device (100) according to claim 10, wherein each jaw (262, 264) defines a cam slot therein and wherein a cam pin is slidably disposed within each cam slot defined in the jaws (262, 264), and wherein the cam pin is connected to the inner shaft such that translation of the inner shaft results in translation of the cam pin through the cam slots.

12. The endoscopic surgical device (100) according to claim 11, wherein the keyed member (348) defines at least one outer longitudinally extending groove and wherein the rotation collar (340) includes at least one corresponding guide projecting into a respective groove of the keyed member (348), wherein rotation of the rotation collar (340) imparts rotation to keyed member (348) and the inner shaft and wherein the keyed member (348) and the inner shaft are axially translatable relative to the rotation collar (340).

Patentansprüche

1. Endoskopische chirurgische Vorrichtung (100), umfassend:

eine Griffanordnung (300), einschließlich eines Drehbunds (340),
eine Röhrenanordnung (200), die an der Griffanordnung (300) betriebsmäßig gestützt ist und sich von dieser erstreckt, wobei die Röhrenanordnung (200) eine Längsachse definiert und eine äußere Röhre (210) und eine innere Spindel aufweist, die schiebbar und drehbar in der äu-

ßeren Röhre (210) angeordnet ist,
eine Gelenkanordnung (230), die an einem distalen Ende der Röhrenanordnung (200) betriebsmäßig gestützt ist und sich von diesem erstreckt,
eine Werkzeuganordnung (260), die an einem distalen Ende der Gelenkanordnung (230) betriebsmäßig gestützt ist und sich von diesem erstreckt und mit einem distalen Ende der inneren Spindel verbunden ist,
wobei
der Drehbund (340) der Griffanordnung (300) über die innere Spindel so mit der Werkzeuganordnung (260) verbunden ist, dass eine Drehung des Drehbunds (340) um die Längsachse zu einer Mitdrehung der Werkzeuganordnung (260) führt,
die Griffanordnung (300) so mit der Werkzeuganordnung (260) verbunden ist, dass eine Betätigung der Griffanordnung (300) auf eine bestimmte Art und Weise zu einer Mitbetätigung der Werkzeuganordnung (260) führt, und
die Griffanordnung (300) so mit der Werkzeuganordnung (260) verbunden ist, dass ein Schwenken der Griffanordnung (300) in einer beliebigen außerachsigen Richtung bezüglich der Längsachse zu einer Mitartikulation der Werkzeuganordnung (260) über die Gelenkanordnung (230) führt, **dadurch gekennzeichnet, dass**
die Griffanordnung (300) ferner ein Stellglied (350) einschließlich einer Schlaufe (352) und eines sich davon erstreckenden Schafts (354) aufweist, wobei das Stellglied für eine axiale Translation entlang der Längsachse konfiguriert und mit der inneren Spindel verbunden ist,
wobei eine Betätigung der Griffanordnung (300) zu einer Handhabung des Stellglieds (350) führt, was zu der Translation der inneren Spindel bezüglich der äußeren Röhre (210) führt, um eine Bewegungsmitübertragung an die Werkzeuganordnung (260) zu bewirken, wobei die Bewegung ein Öffnen und Schließen der Werkzeuganordnung (260) ist, und
wobei die Griffanordnung (300) ferner eine Spule (320) aufweist, die ein konkaves äußeres ringförmiges Seitenwandprofil (320a) und ein sich dadurch erstreckendes Lumen (322) definiert.

2. Endoskopische chirurgische Vorrichtung (100) nach Anspruch 1, wobei die Griffanordnung (300) ein Kugelgelenk (330) aufweist und die Griffanordnung (300) mehrere Gelenkkabel (240) aufweist, die jeweils mit ihrem ersten Ende mit dem Kugelgelenk (330) verbunden sind und jeweils ein zweites Ende haben, das sich gleitend durch die Röhrenanordnung (200) und die Gelenkanordnung (230) erstreckt und mit der Werkzeuganordnung (260) verbunden ist, wobei das Kippen der Griffanordnung (300) in einer beliebigen Richtung um das Kugelgelenk (330) bezüglich der Längsachse zu einer Mitartikulation der Werkzeuganordnung (260) führt.

3. Endoskopische chirurgische Vorrichtung (100) nach Anspruch 2, wobei mindestens vier gleichmäßig beabstandete Gelenkkabel (240) um eine mittlere Achse der Röhrenanordnung (200) vorgesehen sind.

4. Endoskopische chirurgische Vorrichtung (100) nach Anspruch 3, wobei das Kugelgelenk (330) eine Kraft in einer proximalen Richtung auf mindestens eines der mehreren Gelenkkabel (240) ausübt, während die Griffanordnung (300) außerachsig gekippt wird, was zu der Mitartikulation der Werkzeuganordnung (260) führt.

5. Endoskopische chirurgische Vorrichtung (100) nach einem der Ansprüche 2 bis 4, wobei die Gelenkanordnung (230) mehrere miteinander wirkverbundene Gelenke (232, 234) aufweist, die mindestens ein Scharniergelenk (232a), das eine Artikulation in einer ersten Querrichtung bezüglich der Längsachse gestattet, und mindestens ein Scharniergelenk (234a), das eine Artikulation in einer zweiten Querrichtung bezüglich der Längsachse gestattet, aufweisen.

6. Endoskopische chirurgische Vorrichtung (100) nach Anspruch 5, wobei das mindestens eine Scharniergelenk (232a), das eine Artikulation in einer ersten Richtung gestattet, und das mindestens eine Scharniergelenk (234a), das eine Artikulation in einer zweiten Richtung gestattet, im Wesentlichen orthogonal zueinander ausgerichtet sind.

7. Endoskopische chirurgische Vorrichtung (100) nach einem der Ansprüche 2 bis 6, wobei der Drehbund (340) ein darin angeordnetes mit Keilen versehenes Element (348) aufweist, wobei der Drehbund (340) und das mit Keilen versehene Element (348) so miteinander verbunden sind, dass durch eine Drehung des Drehbunds (340) eine Drehung auf das mit Keilen versehene Element (348) übertragen wird, und dass das mit Keilen versehene Element (348) axial bezüglich des Drehbunds (340) beweglich ist.

8. Endoskopische chirurgische Vorrichtung (100) nach Anspruch 7, wobei ein proximales Ende der inneren Spindel mit dem mit Keilen versehenen Element (348) verbunden ist und ein distales Ende der inneren Spindel mit der Werkzeuganordnung (260) verbunden ist.

9. Endoskopische chirurgische Vorrichtung (100) nach Anspruch 8, wobei das mit Keilen versehene Element (348) mindestens eine äußere, sich in Längs-

richtung erstreckende Nut definiert und wobei der Drehbund (340) mindestens eine entsprechende Führung aufweist, die in eine jeweilige Nut (348a) des mit Keilen versehenen Elements (348) hineinragt, wobei das mit Keilen versehene Element (348) und die innere Spindel durch eine Drehung des Drehbunds (340) mit Drehung beaufschlagt werden und wobei die Werkzeuganordnung (260) durch eine Drehung der inneren Spindel mit Drehung beaufschlagt wird.

10. Endoskopische chirurgische Vorrichtung (100) nach einem der Ansprüche 2 bis 9, wobei die Werkzeuganordnung (260) ein Paar nebeneinander angeordnete Backen (262, 264) aufweist, die mit einem distalen Ende der inneren Spindel so wirkverbunden sind, dass ein Hin- und Hergehen der inneren Spindel bezüglich der äußeren Röhre (210) zu einem Öffnen und Schließen der Backen (262, 264) führt und eine Drehung der inneren Spindel bezüglich der äußeren Röhre (210) zu einer Drehung der Backen (262, 264) führt.

11. Endoskopische chirurgische Vorrichtung (100) nach Anspruch 10, wobei jede Backe (262, 264) einen Nockenschlitz darin definiert und wobei ein Nockenstift gleitend in jedem in den Backen (262, 264) definierten Nockenschlitz angeordnet ist, und wobei der Nockenstift so mit der inneren Spindel verbunden ist, dass eine Translation der inneren Spindel zu einer Translation des Nockenstifts durch die Nockenschlitze führt.

12. Endoskopische chirurgische Vorrichtung (100) nach Anspruch 11, wobei das mit Keilen versehene Element (348) mindestens eine äußere, sich in Längsrichtung erstreckende Nut definiert und wobei der Drehbund (340) mindestens eine entsprechende Führung aufweist, die in eine entsprechende Nut des mit Keilen versehenen Elements (348) ragt, wobei das mit Keilen versehene Element (348) und die innere Spindel durch eine Drehung des Drehbunds (340) mit Drehung beaufschlagt werden und wobei das mit Keilen versehene Element (348) und die innere Spindel axial bezüglich des Drehbunds (340) translatierbar sind.

Revendications

1. Dispositif chirurgical endoscopique (100), comprenant :

un ensemble de poignée (300) comportant un collier rotatif (340) ;
un ensemble de tube (200) supporté fonctionnellement sur l'ensemble de poignée (300) et s'étendant depuis celui-ci, l'ensemble de tube (200) définissant un axe longitudinal et comportant un tube extérieur (210) et un arbre intérieur disposé de manière à pouvoir coulisser et tourner dans le tube extérieur (210) ;
un ensemble d'articulation (230) supporté de manière fonctionnelle sur une extrémité distale de l'ensemble de tube (200) et s'étendant depuis celle-ci ;
un ensemble d'outil (260) supporté fonctionnellement sur une extrémité distale de l'ensemble d'articulation (230) et s'étendant depuis celle-ci et connecté à une extrémité distale de l'arbre intérieur,
le collier rotatif (340) de l'ensemble de poignée (300) étant connecté à l'ensemble d'outil (260) par le biais de l'arbre intérieur de telle sorte qu'une rotation du collier rotatif (340) autour de l'axe longitudinal entraîne une rotation concomitante de l'ensemble d'outil (260) ;
l'ensemble de poignée (300) étant connecté à l'ensemble d'outil (260) de telle sorte qu'un actionnement de l'ensemble de poignée (300) d'une manière particulière entraîne un actionnement concomitant de l'ensemble d'outil (260) ; et
l'ensemble de poignée (300) étant connecté à l'ensemble d'outil (260) de telle sorte qu'un pivotement de l'ensemble de poignée (300) dans n'importe quelle direction désaxée par rapport à l'axe longitudinal entraîne une articulation concomitante de l'ensemble d'outil (260) par le biais de l'ensemble d'articulation (230) ; **caractérisé en ce que**
l'ensemble de poignée (300) comporte en outre un actionneur (350) comportant une boucle (352) et une tige (354) s'étendant depuis celle-ci, l'actionneur étant configuré de manière à se déplacer en translation axialement le long de l'axe longitudinal et étant connecté à l'arbre intérieur,
l'actionnement de l'ensemble de poignée (300) donnant lieu à la manipulation de l'actionneur (350) pour produire la translation de l'arbre intérieur par rapport au tube extérieur (210) pour effectuer une transmission concomitante du mouvement à l'ensemble d'outil (260), le mouvement étant une ouverture ou une fermeture de l'ensemble d'outil (260) ; et
l'ensemble de poignée (300) comportant en outre une bobine (320) définissant un profil de paroi latérale annulaire extérieure concave (320a) et une lumière (322) s'étendant à travers lui.

2. Dispositif chirurgical endoscopique (100) selon la revendication 1, dans lequel l'ensemble de poignée (300) comporte un joint à bille (330), et l'ensemble de poignée (300) comporte une pluralité de câbles

d'articulation (240), chacun ayant une première extrémité connectée au joint à bille (330) et chacun ayant une deuxième extrémité s'étendant de manière coulissante à travers l'ensemble de tube (200) et l'ensemble d'articulation (230), et étant connecté à l'ensemble d'outil (260), l'inclinaison de l'ensemble de poignée (300) dans une direction quelconque autour du joint à bille (330), par rapport à l'axe longitudinal, entraînant une articulation concomitante de l'ensemble d'outil (260).

3. Dispositif chirurgical endoscopique (100) selon la revendication 2, dans lequel au moins quatre câbles d'articulation espacés uniformément (240) sont prévus autour d'un axe central de l'ensemble de tube (200).

4. Dispositif chirurgical endoscopique (100) selon la revendication 3, dans lequel, à mesure que l'ensemble de poignée (300) est incliné de manière désaxée, le joint à bille (330) exerce une force dans une direction proximale sur au moins l'un de ladite pluralité de câbles d'articulation (240), ce qui entraîne l'articulation concomitante de l'ensemble d'outil (260).

5. Dispositif chirurgical endoscopique (100) selon l'une quelconque des revendications 2 à 4, dans lequel l'ensemble d'articulation (230) comporte une pluralité de joints (232, 234) connectés fonctionnellement les uns aux autres, la pluralité de joints (232, 234) comportant au moins une rotule (232a) permettant l'articulation dans une première direction transversale par rapport à l'axe longitudinal, et au moins une rotule (234a) permettant l'articulation dans une deuxième direction transversale par rapport à l'axe longitudinal.

6. Dispositif chirurgical endoscopique (100) selon la revendication 5, dans lequel l'au moins une rotule (232a) permettant l'articulation dans une première direction et l'au moins une rotule (234a) permettant l'articulation dans une deuxième direction sont orientées substantiellement de manière perpendiculaire l'une à l'autre.

7. Dispositif chirurgical endoscopique (100) selon l'une quelconque des revendications 2 à 6, dans lequel le collier rotatif (340) comporte un organe claveté (348) disposé dans celui-ci, le collier rotatif (340) et l'organe claveté (348) étant connectés l'un à l'autre de telle sorte que la rotation du collier rotatif (340) transmette une rotation à l'organe claveté (348) et de telle sorte que l'organe claveté (348) puisse être déplacé axialement par rapport au collier rotatif (340).

8. Dispositif chirurgical endoscopique (100) selon la revendication 7, dans lequel une extrémité proximale de l'arbre intérieur est connectée à l'organe claveté (348) et une extrémité distale de l'arbre intérieur est connectée à l'ensemble d'outil (260).

9. Dispositif chirurgical endoscopique (100) selon la revendication 8, dans lequel l'organe claveté (348) définit au moins une rainure extérieure s'étendant longitudinalement et dans lequel le collier rotatif (340) comporte au moins un guide correspondant faisant saillie dans une rainure respective (348a) de l'organe claveté (348), la rotation du collier rotatif (340) conférant une rotation à l'organe claveté (348) et à l'arbre intérieur, et la rotation de l'arbre intérieur conférant une rotation à l'ensemble d'outil (260).

10. Dispositif chirurgical endoscopique (100) selon l'une quelconque des revendications 2 à 9, dans lequel l'ensemble d'outil (260) comporte une paire de mâchoires juxtaposées (262, 264) connectées fonctionnellement à une extrémité distale de l'arbre intérieur de telle sorte qu'un mouvement alternatif de l'arbre intérieur par rapport au tube extérieur (210) entraîne une ouverture et une fermeture des mâchoires (262, 264), et la rotation de l'arbre intérieur par rapport au tube extérieur (210) entraîne une rotation des mâchoires (262, 264).

11. Dispositif chirurgical endoscopique (100) selon la revendication 10, dans lequel chaque mâchoire (262, 264) définit une fente de came dans celle-ci et dans lequel une goupille de came est disposée de manière à pouvoir coulisser à l'intérieur de chaque fente de came définie dans les mâchoires (262, 264), la goupille de came étant connectée à l'arbre intérieur de telle sorte que la translation de l'arbre intérieur entraîne la translation de la goupille de came à travers les fentes de came.

12. Dispositif chirurgical endoscopique (100) selon la revendication 11, dans lequel l'organe claveté (348) définit au moins une rainure extérieure s'étendant longitudinalement et dans lequel le collier rotatif (340) comporte au moins un guide correspondant faisant saillie dans une rainure respective de l'organe claveté (348), la rotation du collier rotatif (340) conférant une rotation à l'organe claveté (348) et à l'arbre intérieur et l'organe claveté (348) et l'arbre intérieur pouvant être déplacés axialement en translation par rapport au collier rotatif (340).

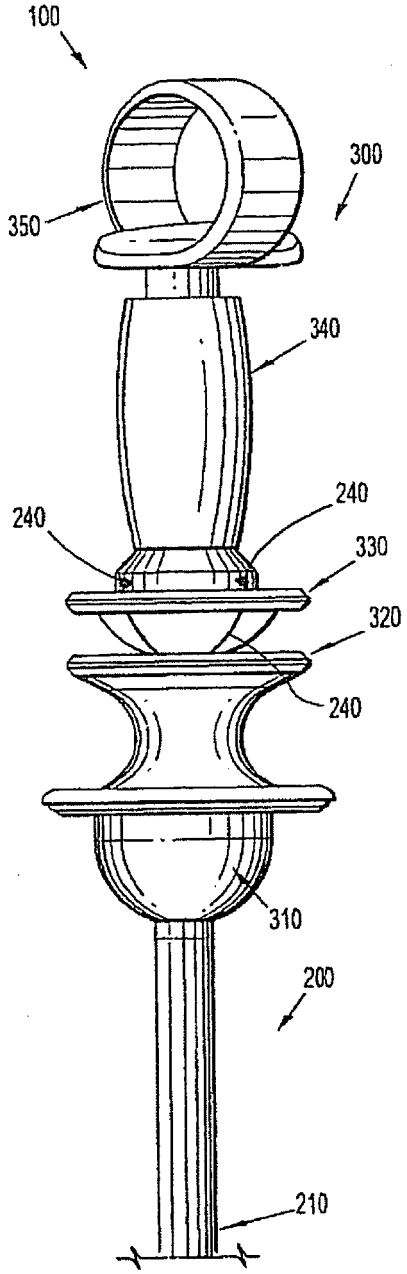
100
300
350
340
240
240
330
320
240
310
200
210

FIG. 1A

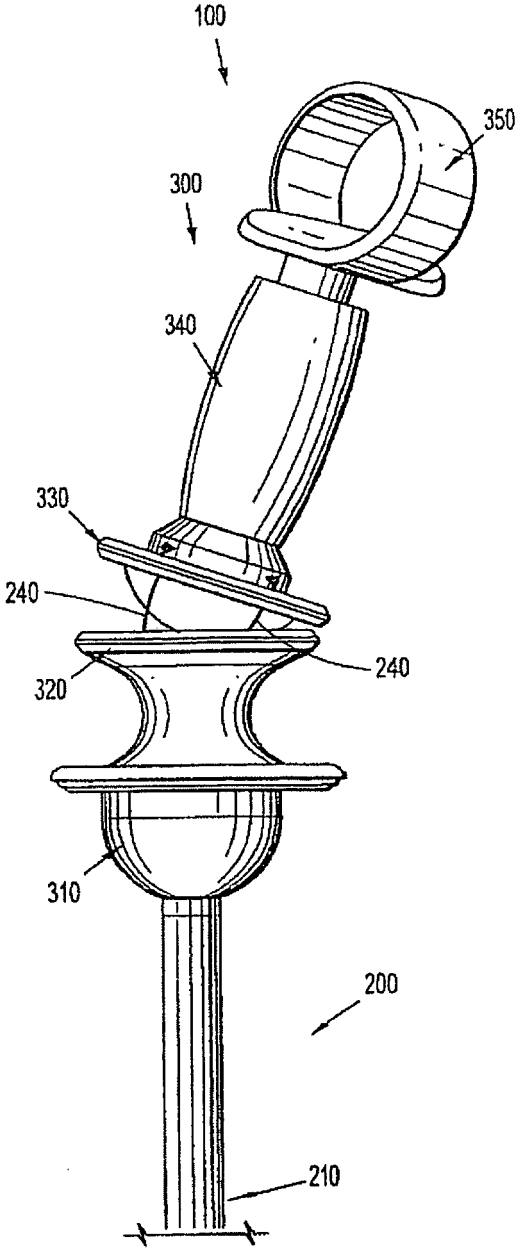
100
350
300
340
330
240
240
320
310
200
210

FIG. 1B

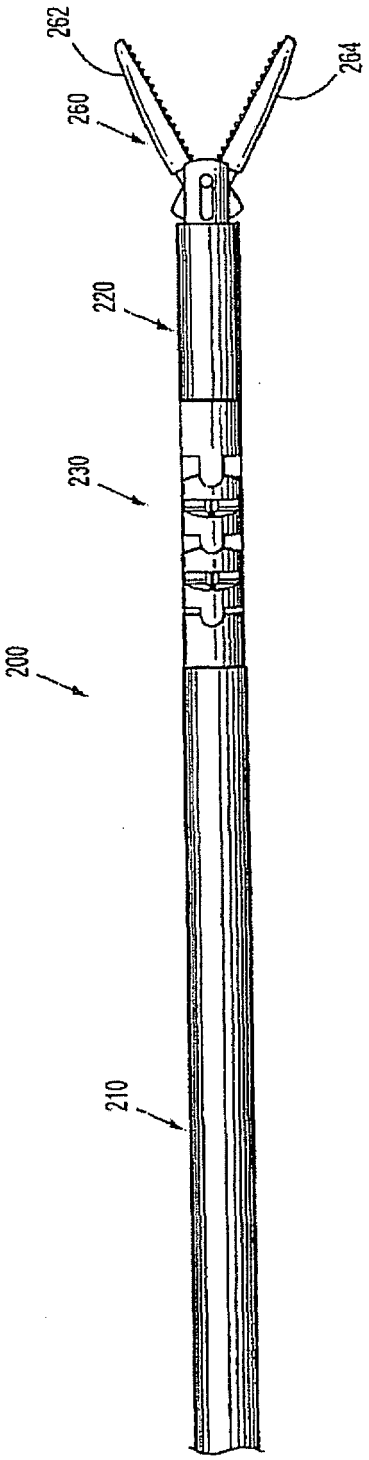

FIG. 2A

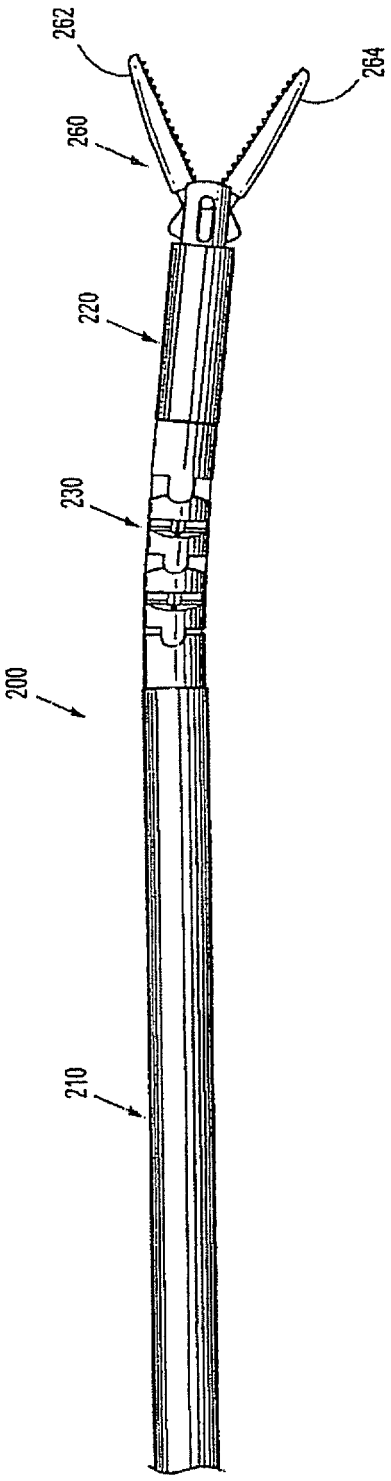

FIG. 2B

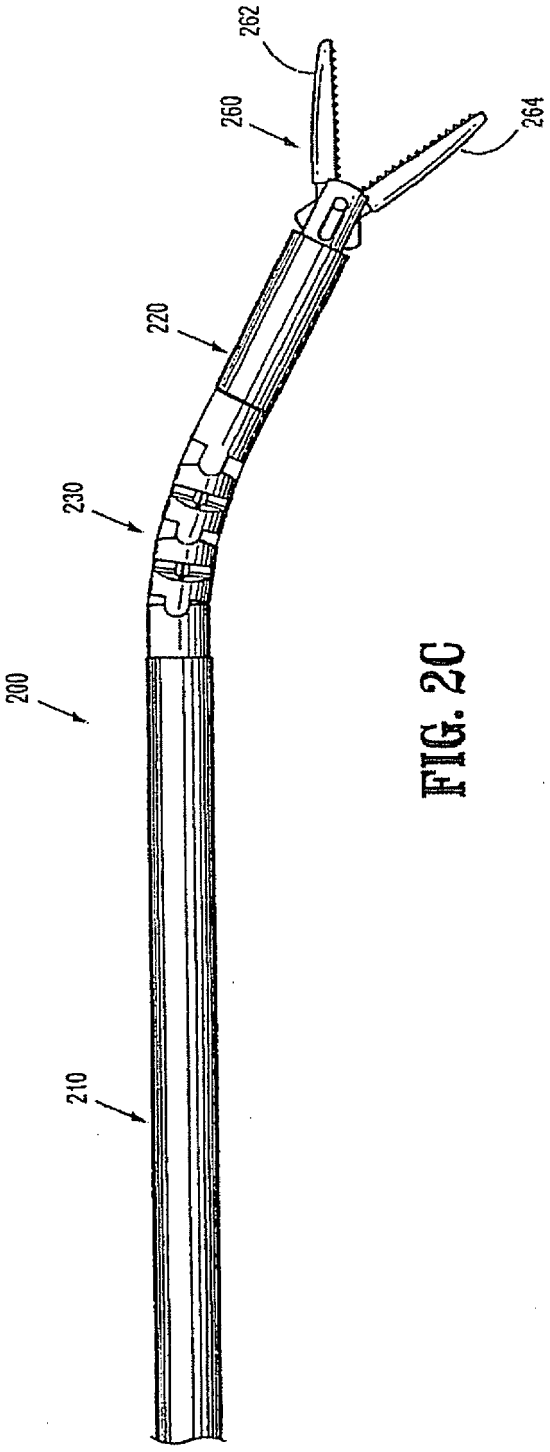

FIG. 2C

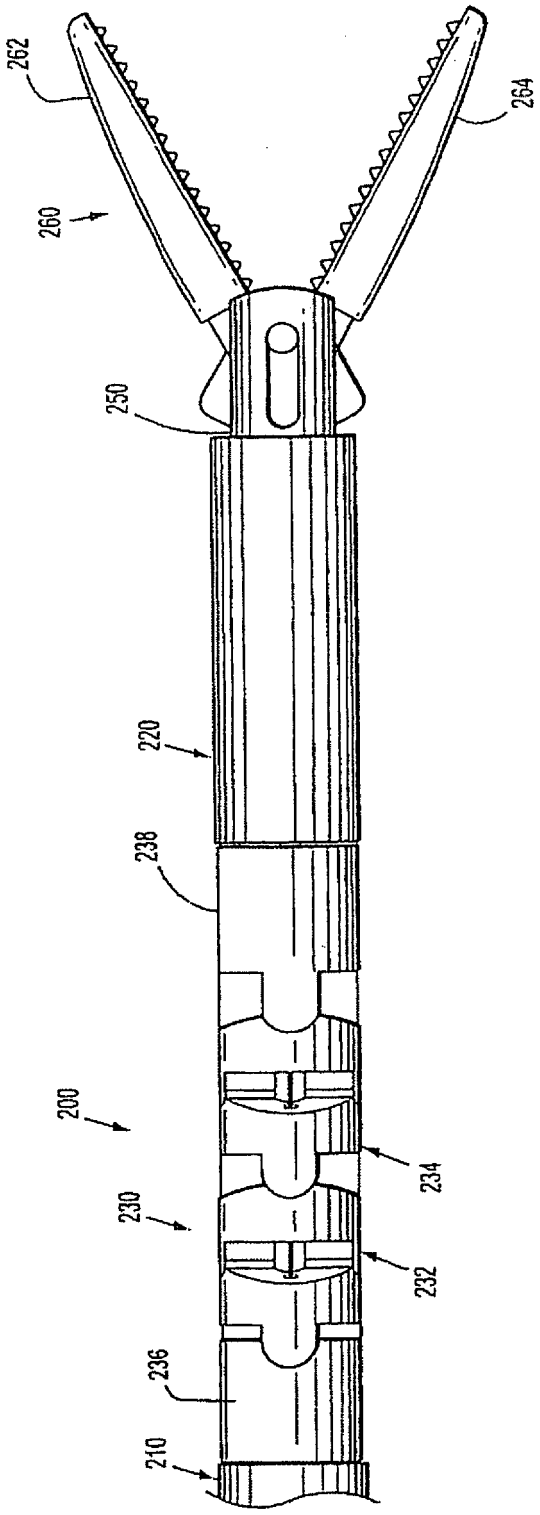

FIG. 3

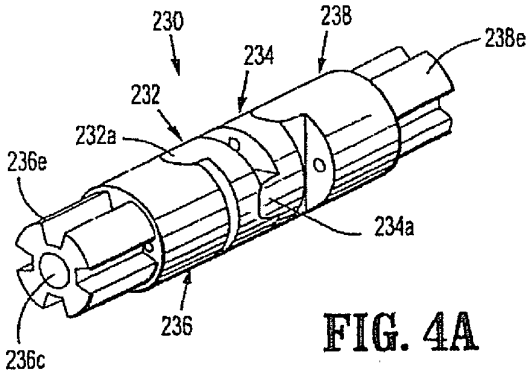

FIG. 4A

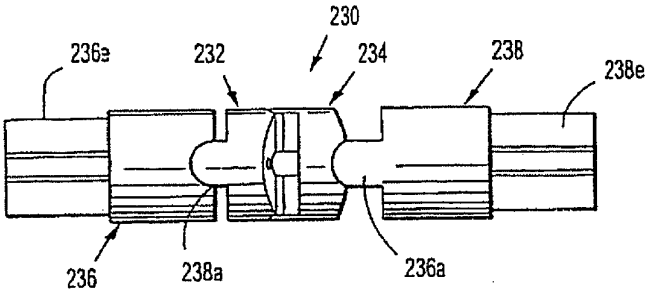

FIG. 4B

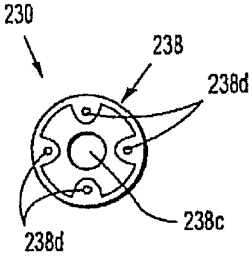

FIG. 4D

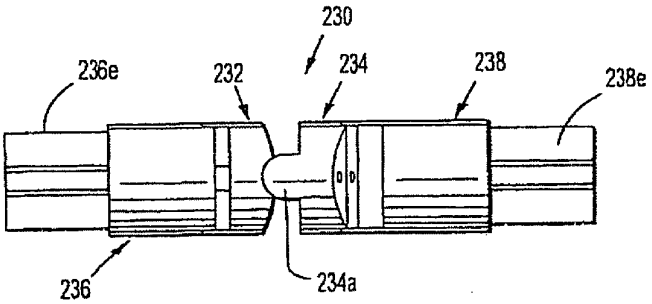

FIG. 4C

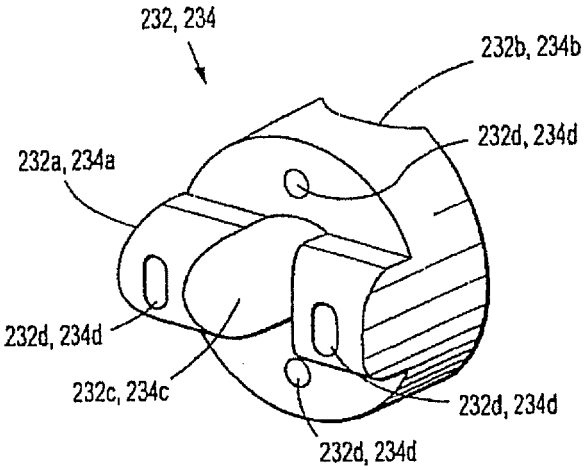

FIG. 5A

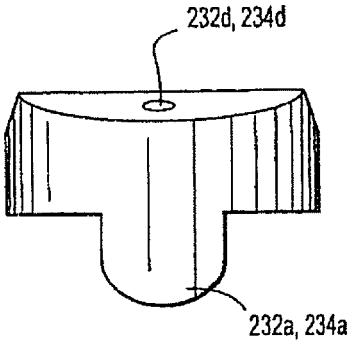

FIG. 5B

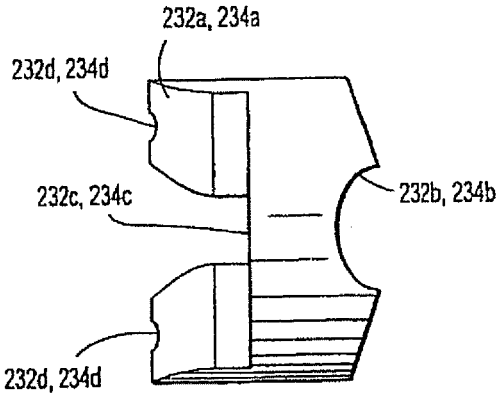

FIG. 5D

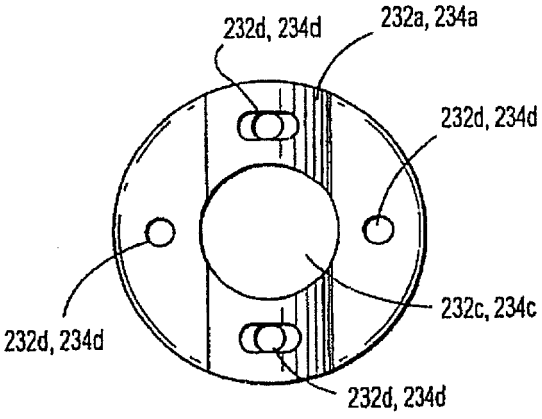

FIG. 5C

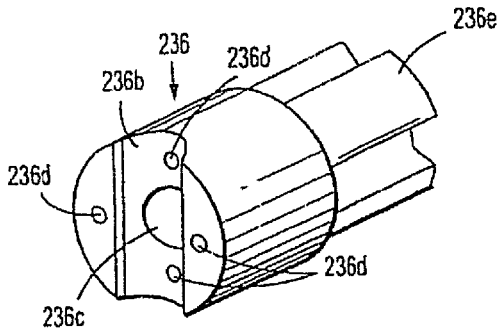

FIG. 6A

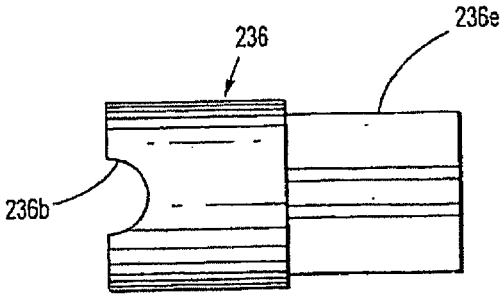

FIG. 6B

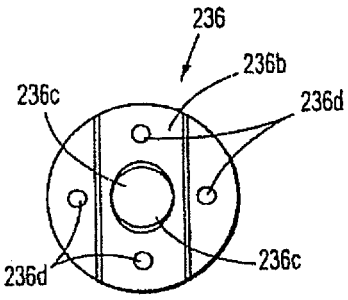

FIG. 6D

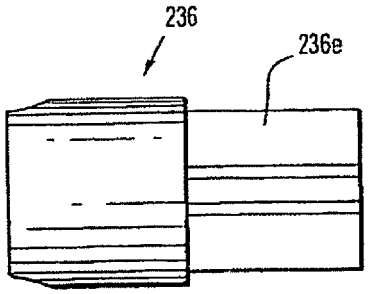

FIG. 6C

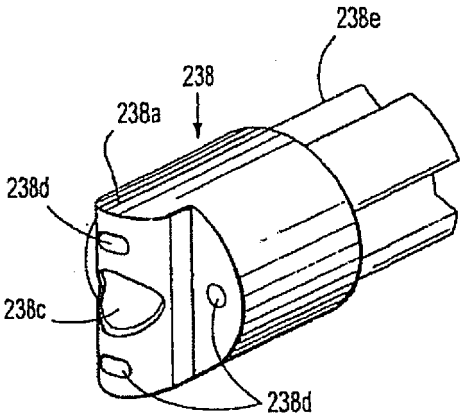

FIG. 7A

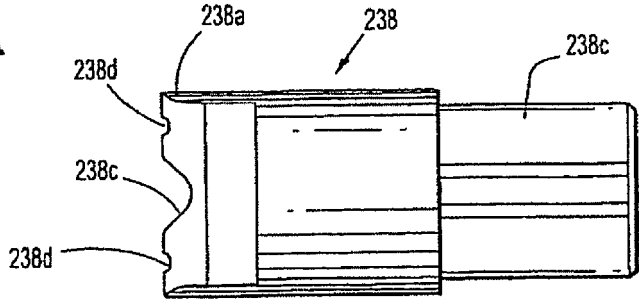

FIG. 7B

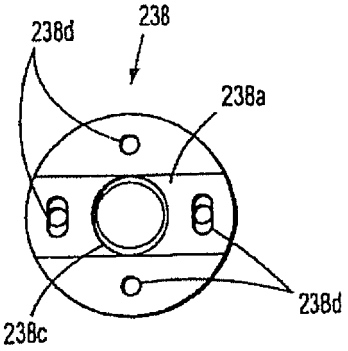

FIG. 7D

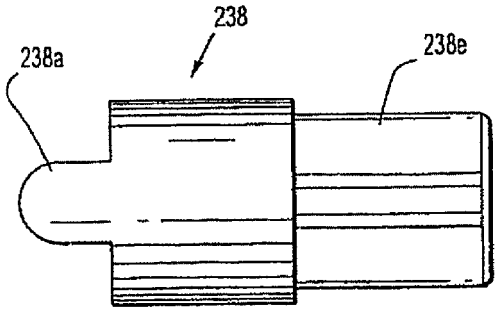

FIG. 7C

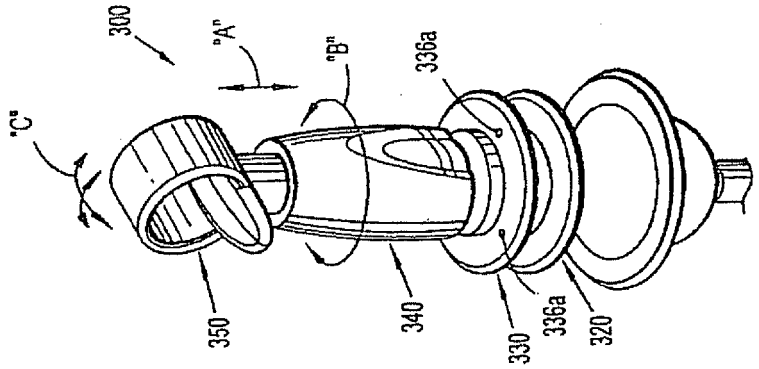

FIG. 8C

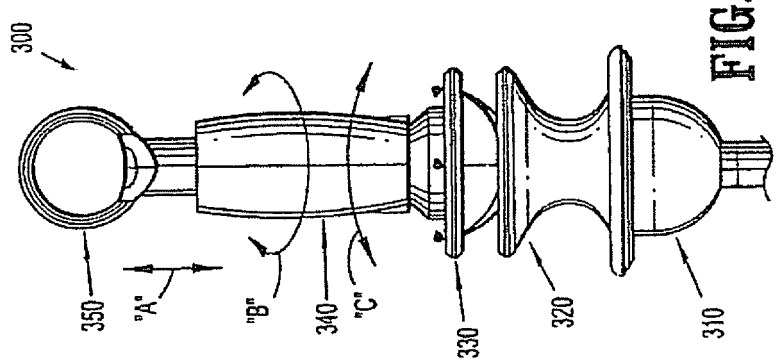

FIG. 8B

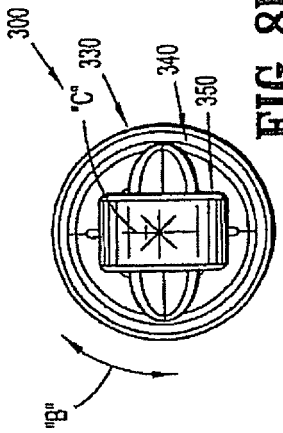

FIG. 8D

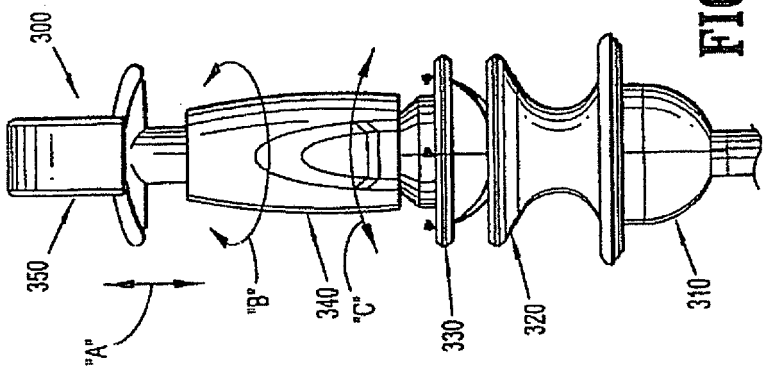

FIG. 8A

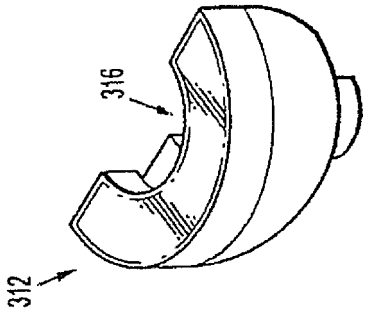

FIG. 9A

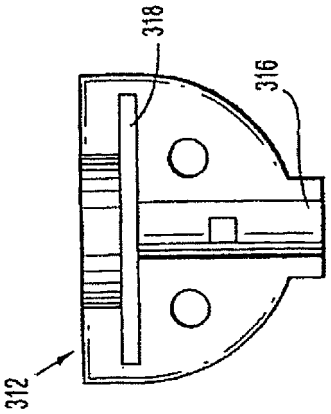

FIG. 9E

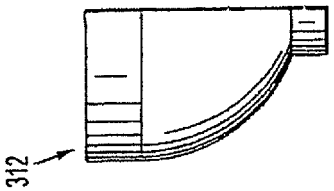

FIG. 9D

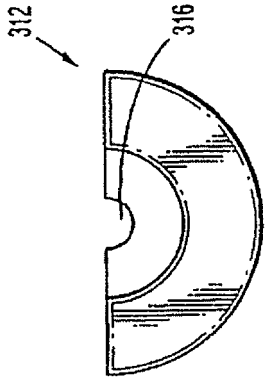

FIG. 9B

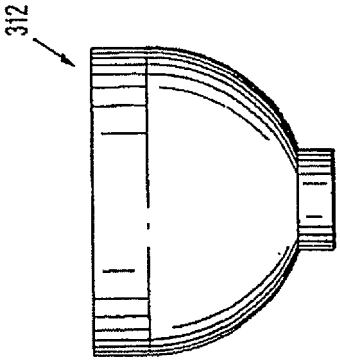

FIG. 9C

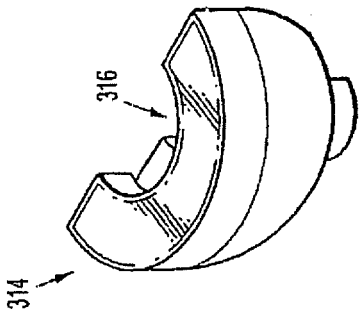

FIG. 10A

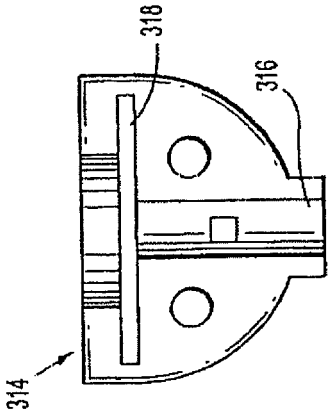

FIG. 10E

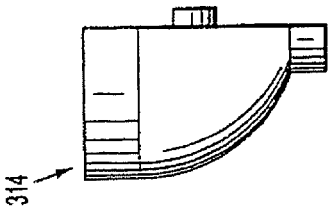

FIG. 10D

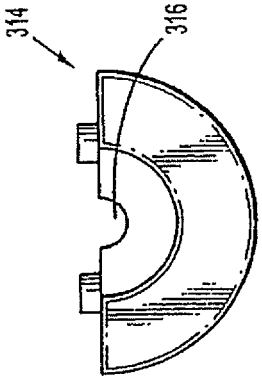

FIG. 10B

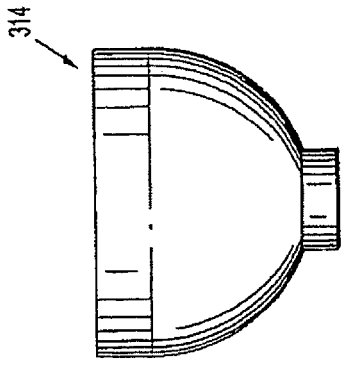

FIG. 10C

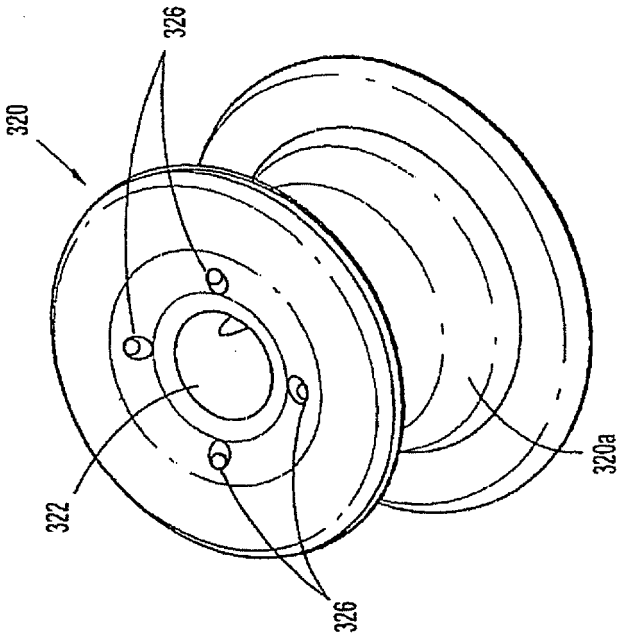

FIG. 11A

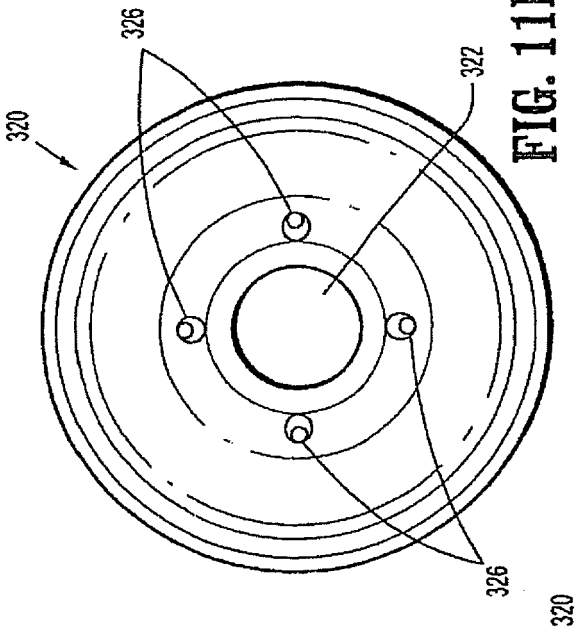

FIG. 11B

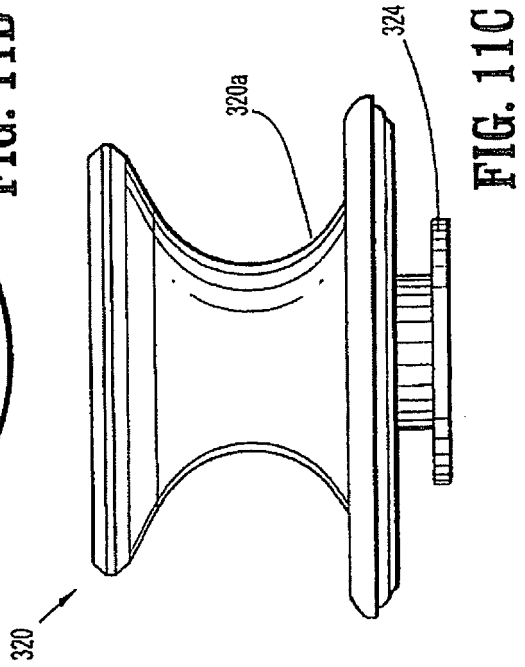

FIG. 11C

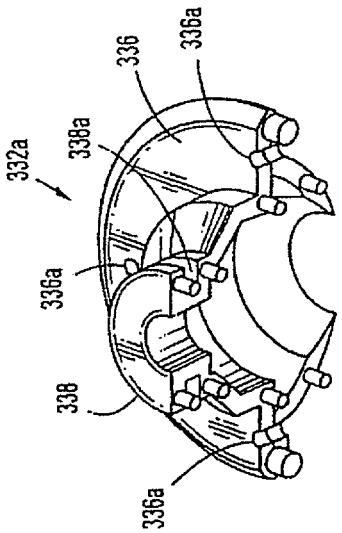

FIG. 12A

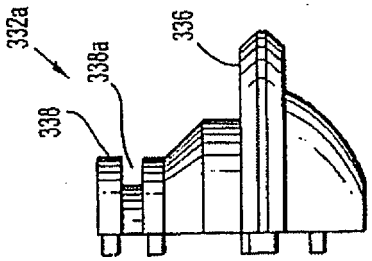

FIG. 12D

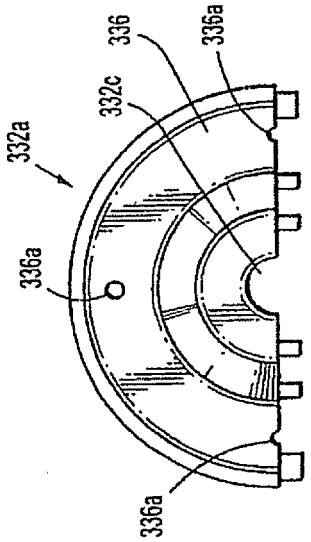

FIG. 12B

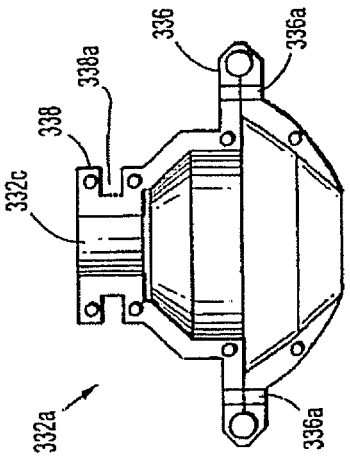

FIG. 12C

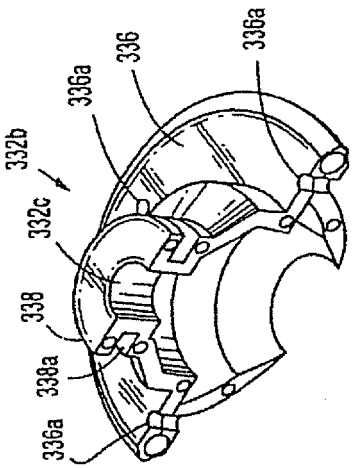

FIG. 13A

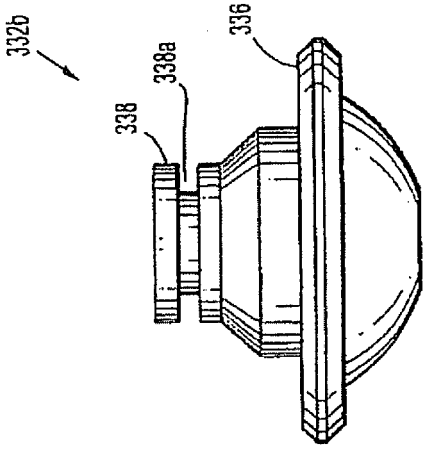

FIG. 13E

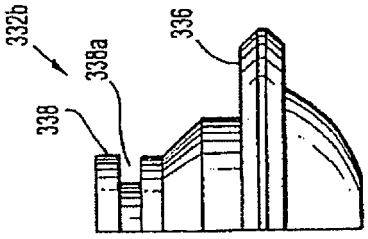

FIG. 13D

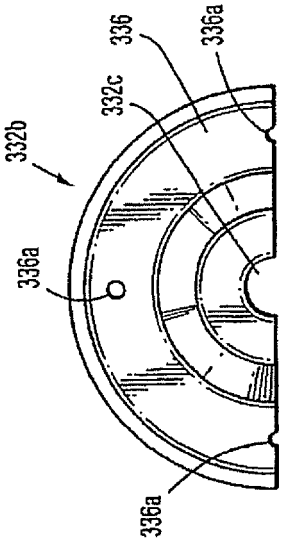

FIG. 13B

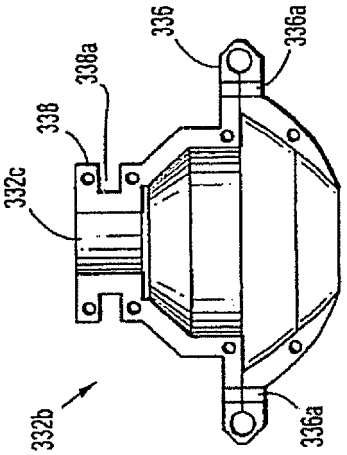

FIG. 13C

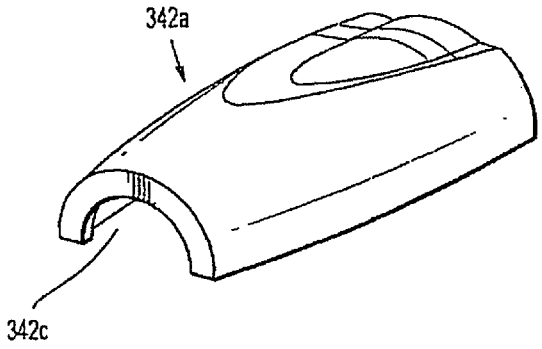

FIG. 14A

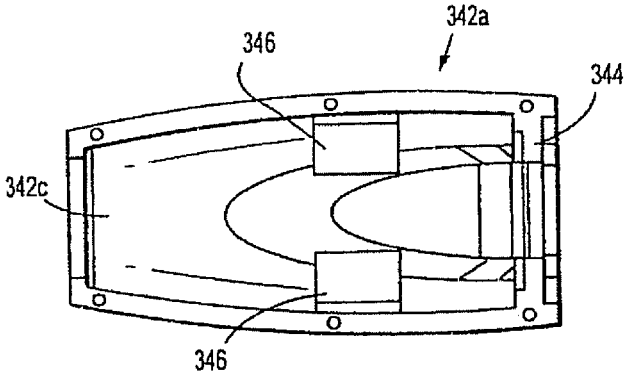

FIG. 14B

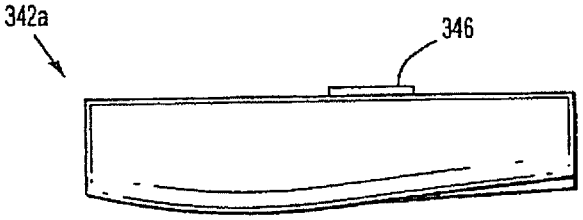

FIG. 14C

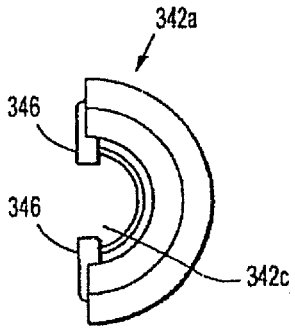

FIG. 14E

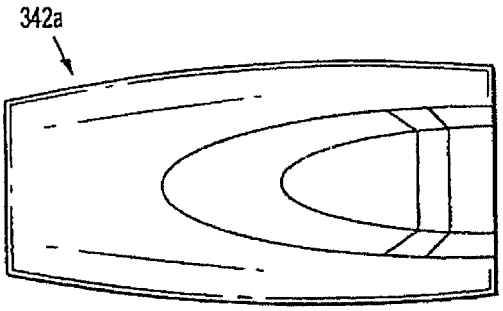

FIG. 14D

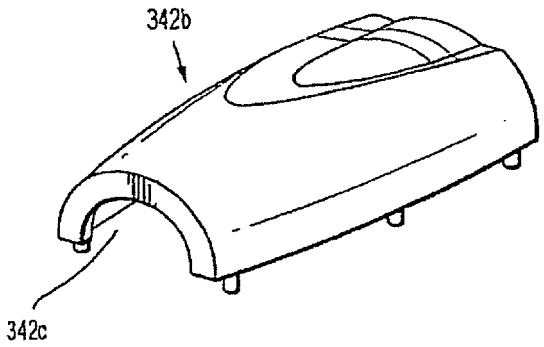

FIG. 15A

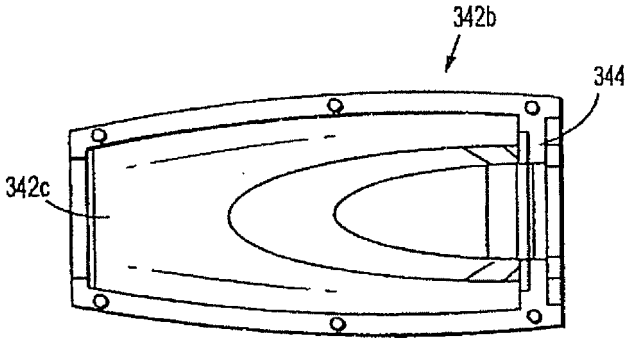

FIG. 15B

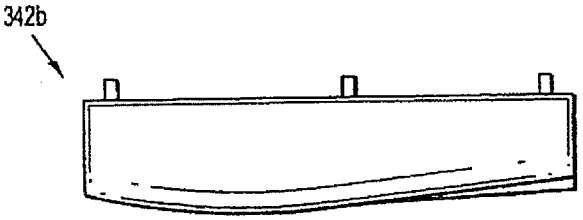

FIG. 15C

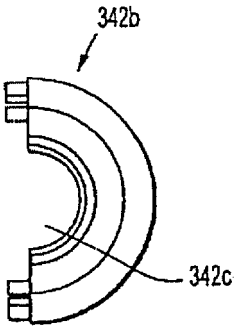

FIG. 15E

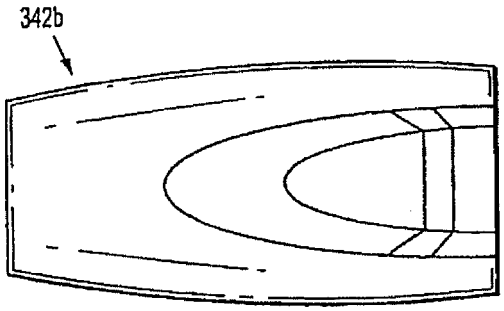

FIG. 15D

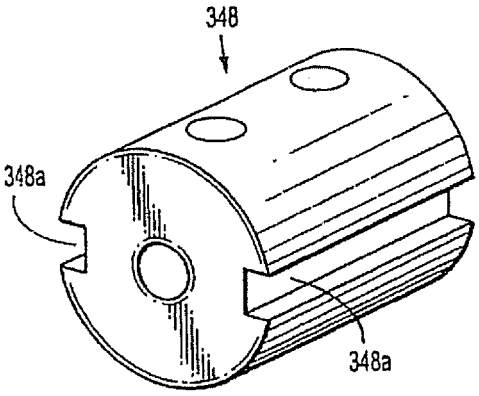

FIG. 16A

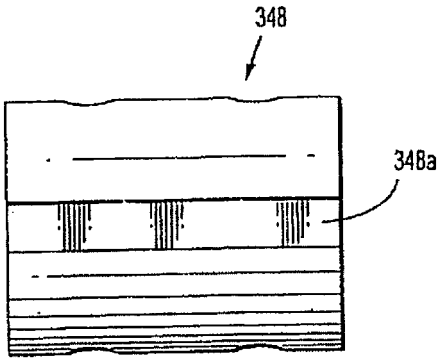

FIG. 16B

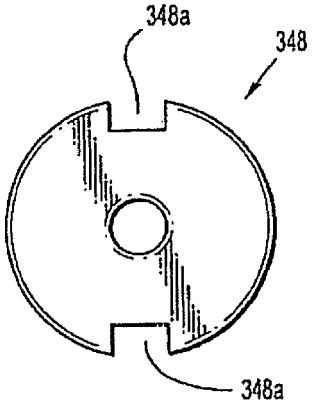

FIG. 16D

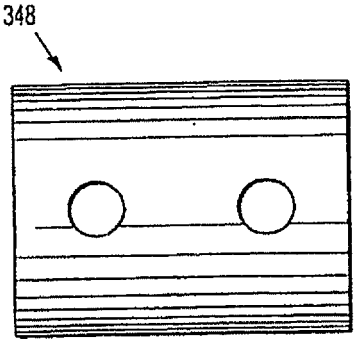

FIG. 16C

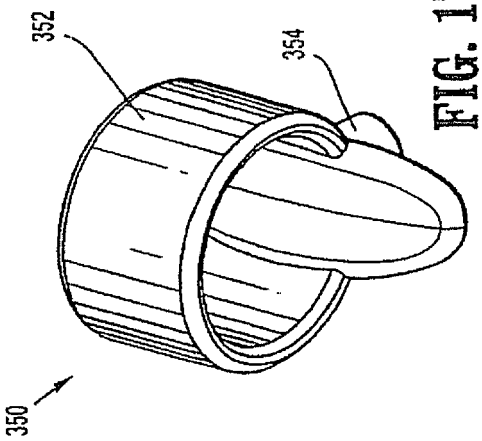

FIG. 17A

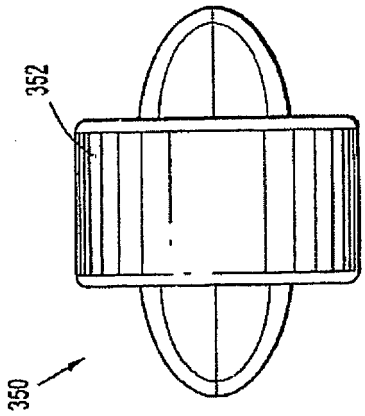

FIG. 17B

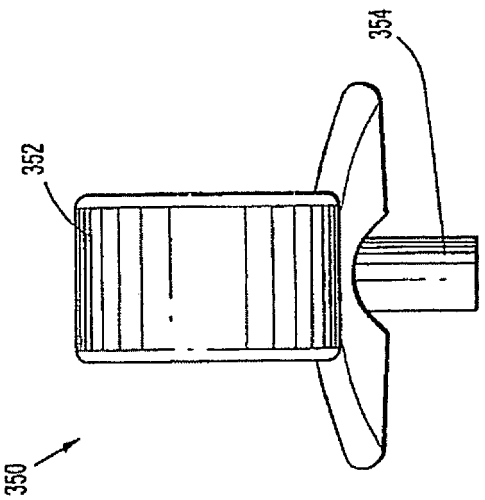

FIG. 17C

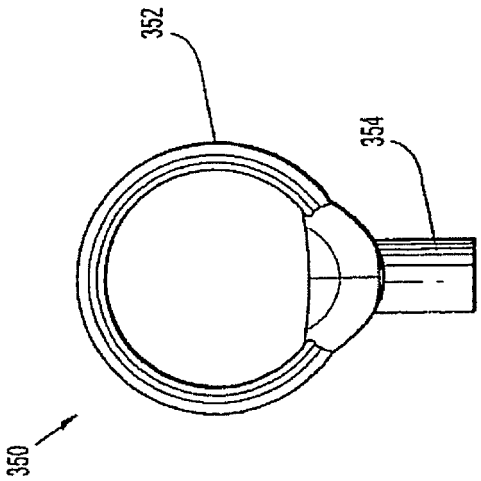

FIG. 17D

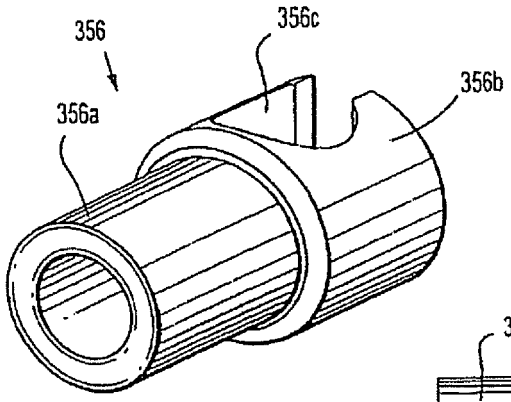

FIG. 18A

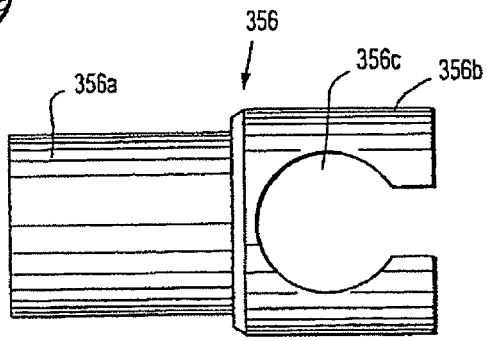

FIG. 18B

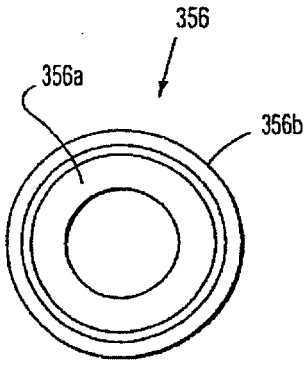

FIG. 18D

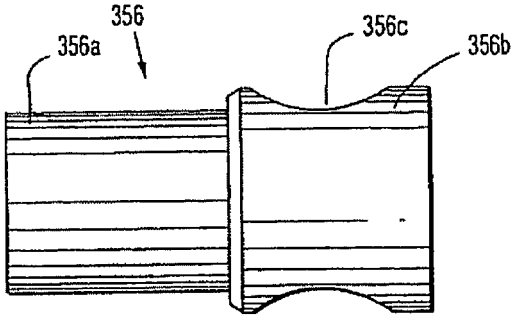

FIG. 18C

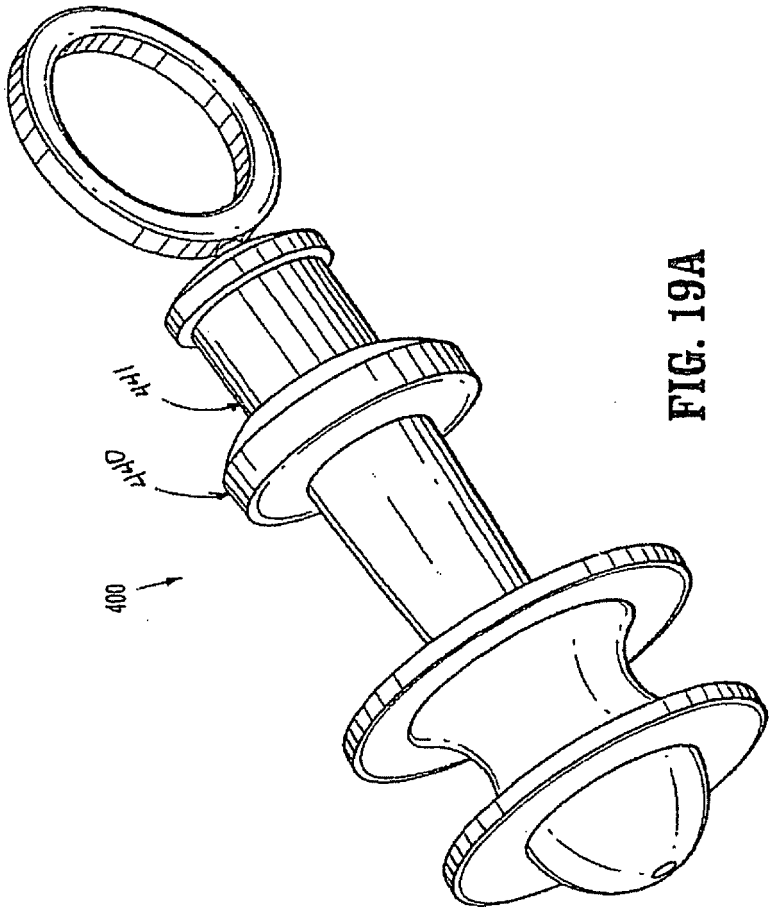

FIG. 19A

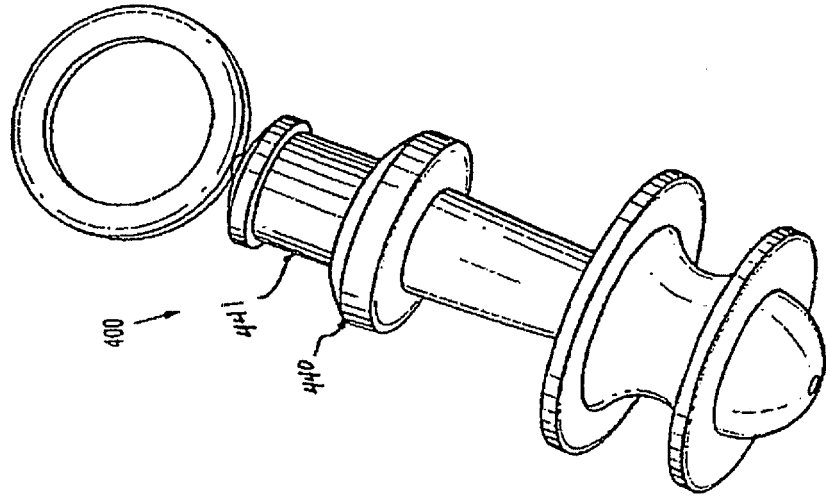

FIG. 19D

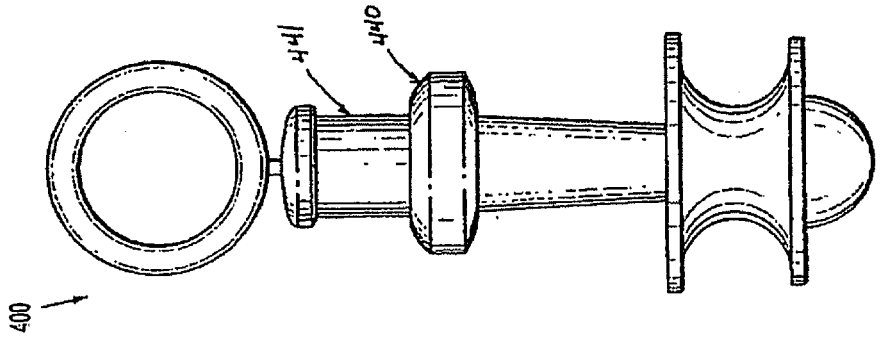

FIG. 19C

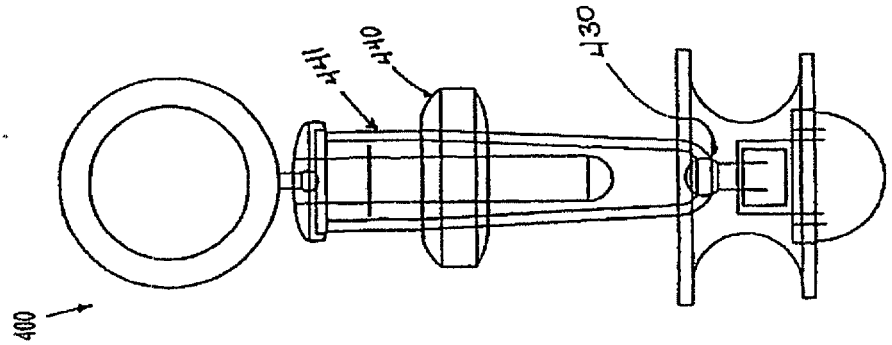

FIG. 19B

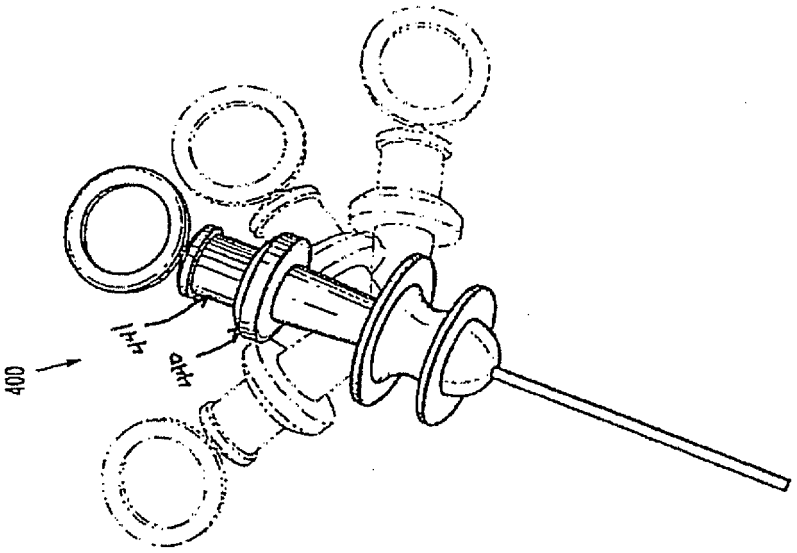

FIG. 19F

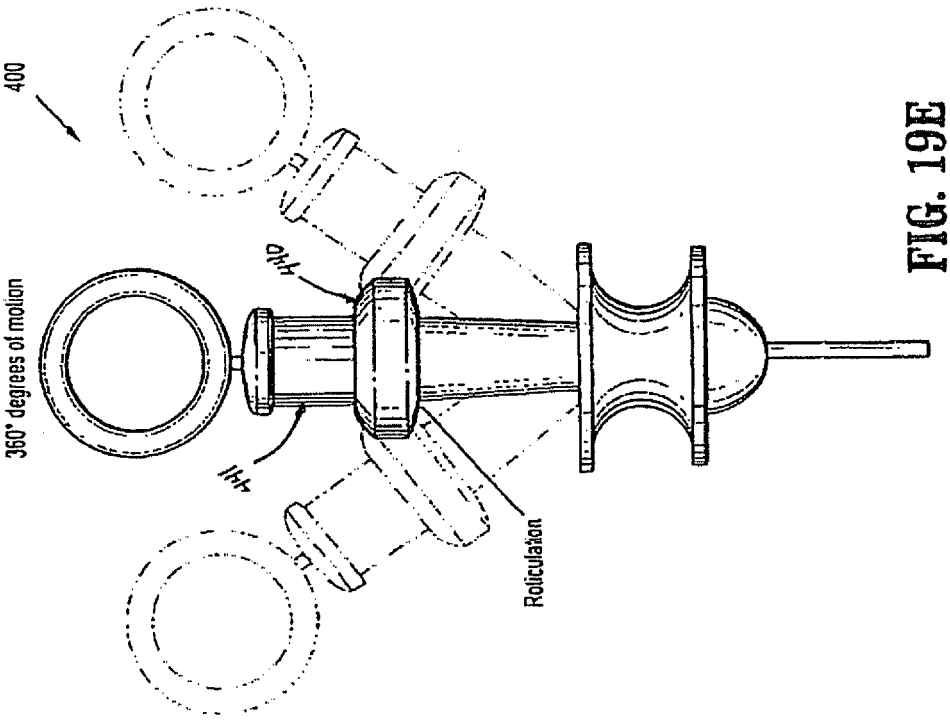

FIG. 19E

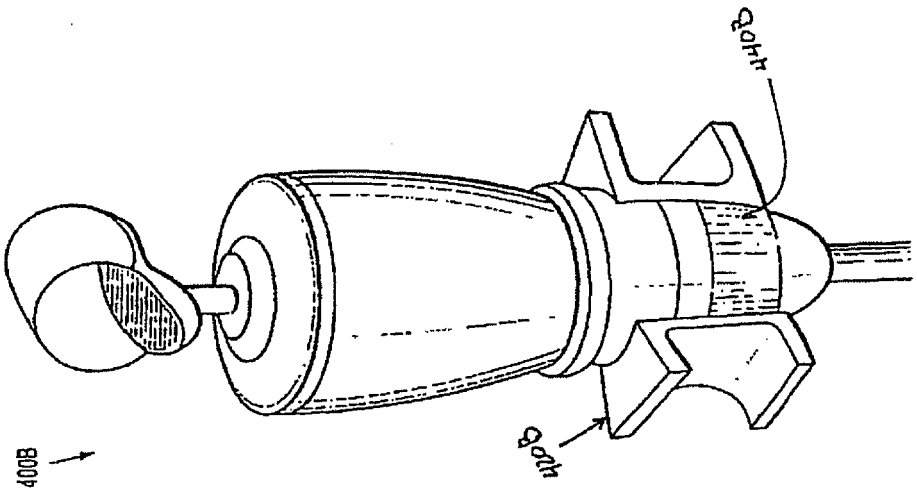

FIG. 20B

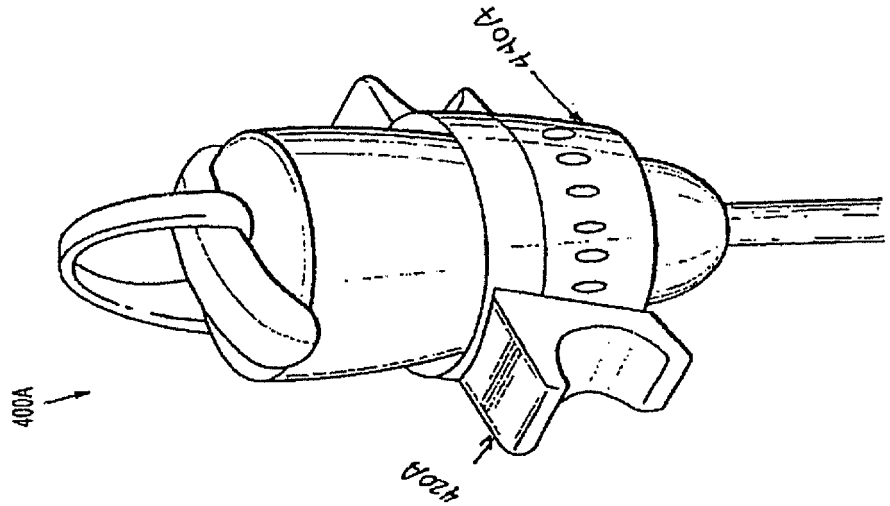

FIG. 20A

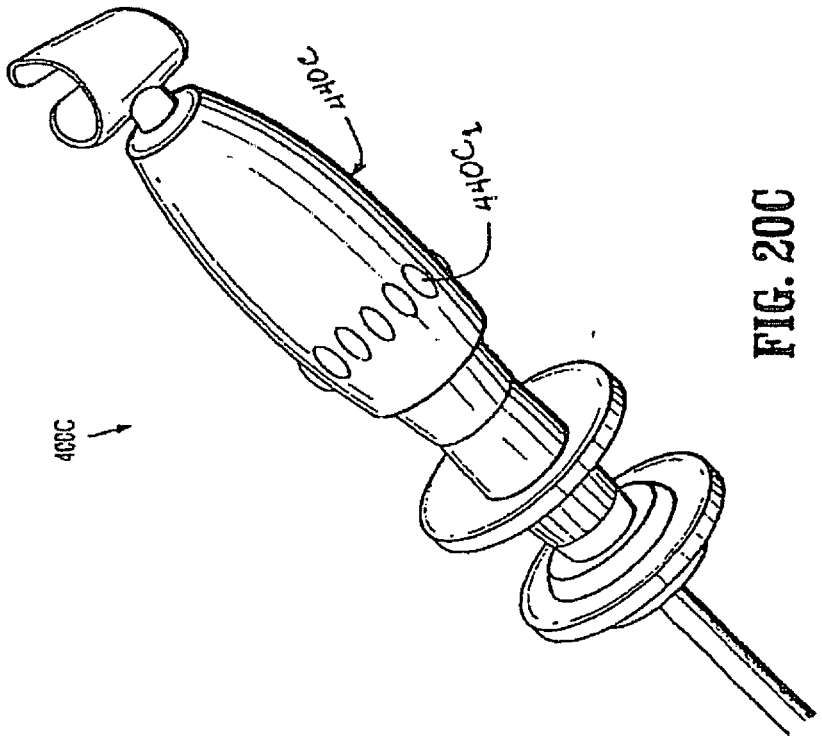

FIG. 20C

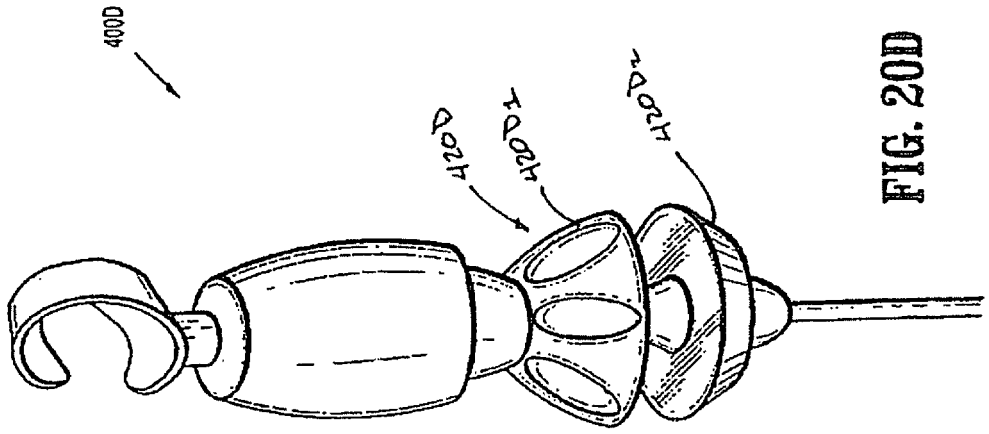

FIG. 20D

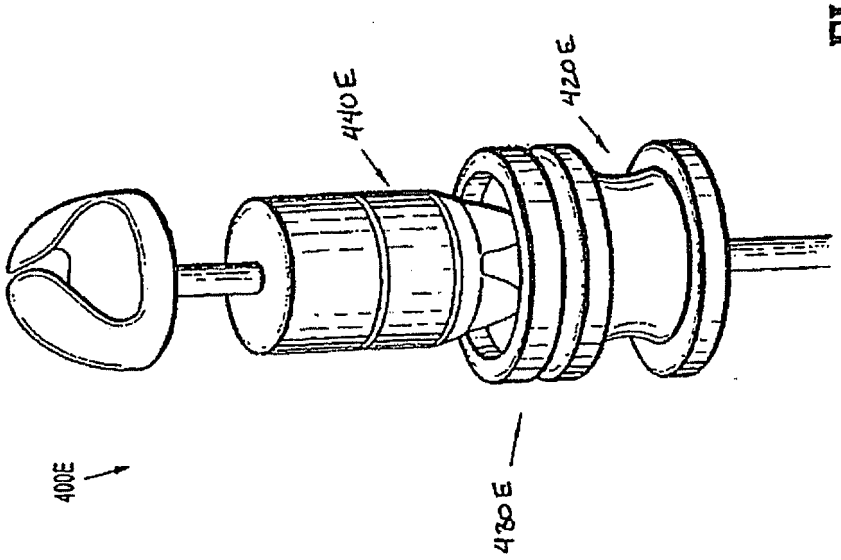

FIG. 20E

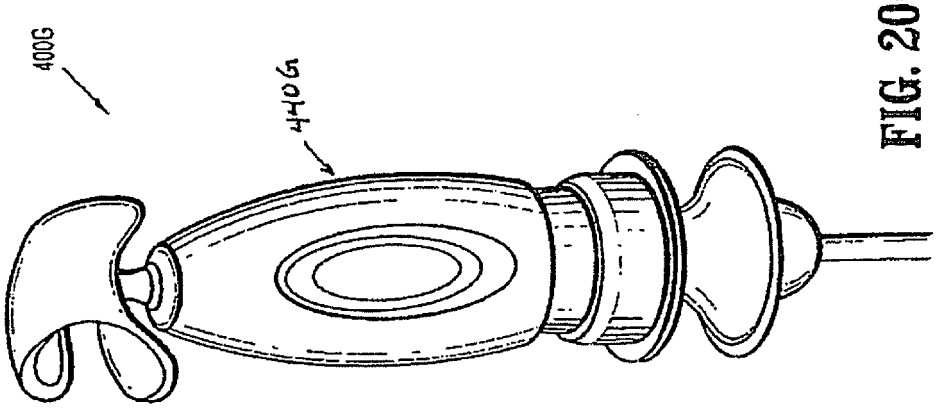

FIG. 20G

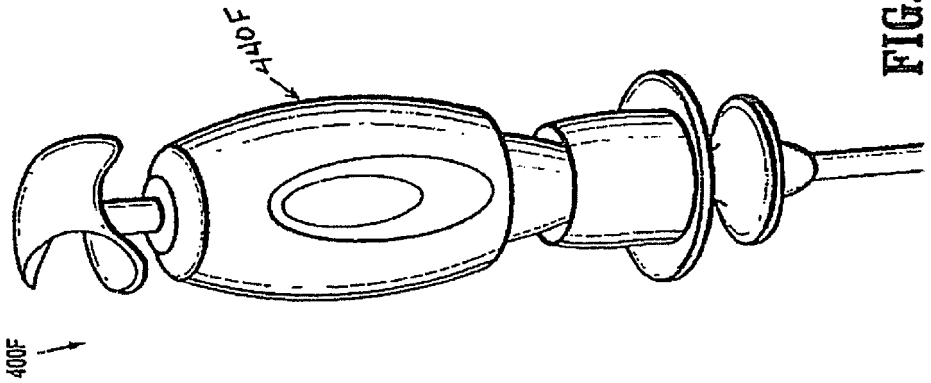

FIG. 20F

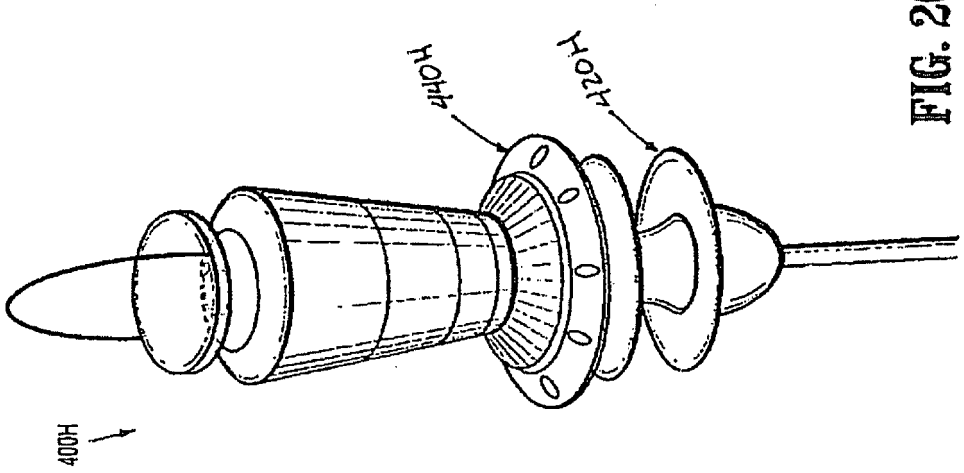

FIG. 20H

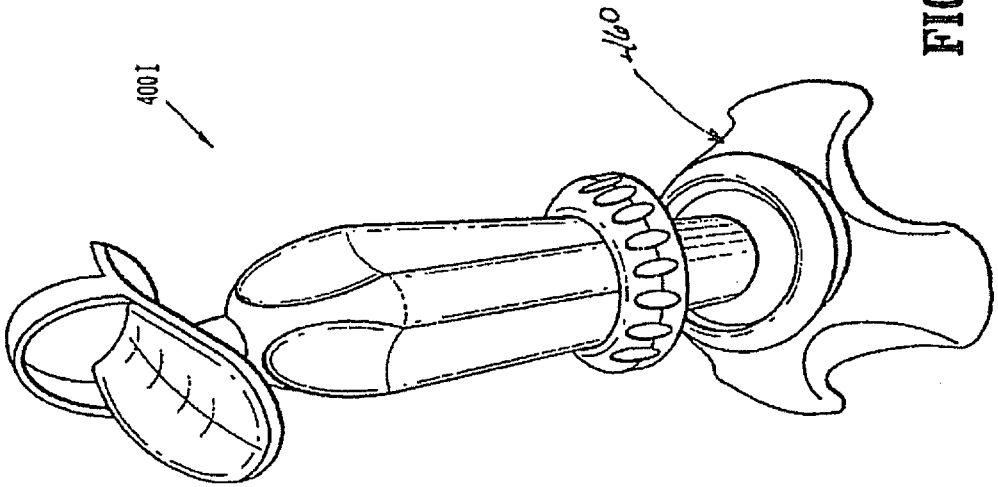

FIG. 20I

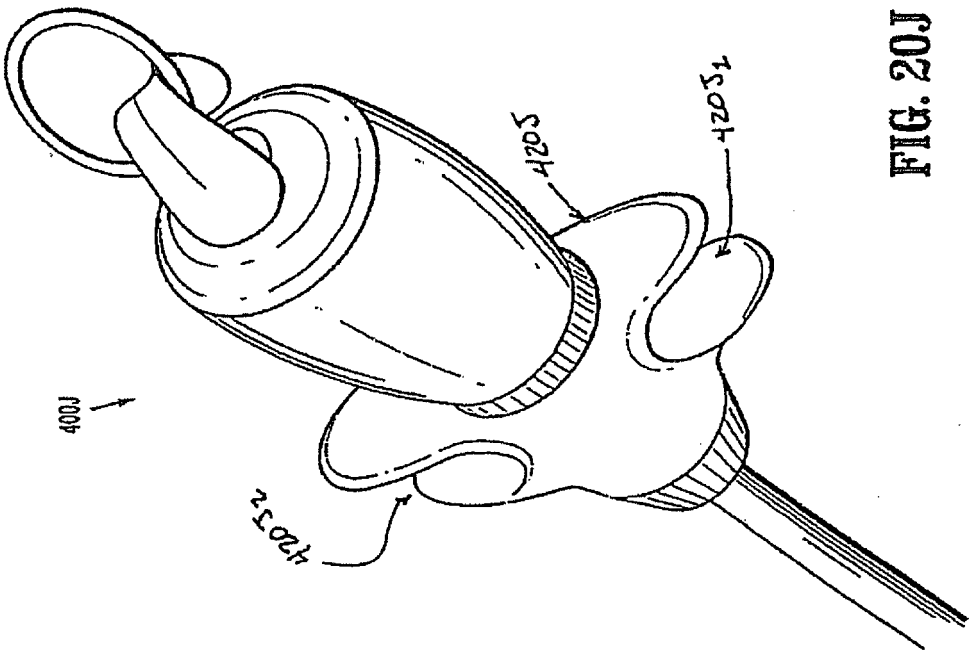

FIG. 20J

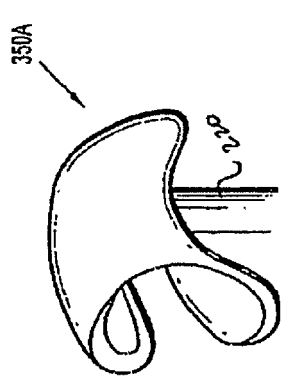

FIG. 21A

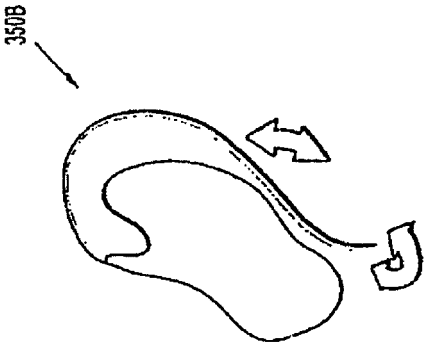

FIG. 21B

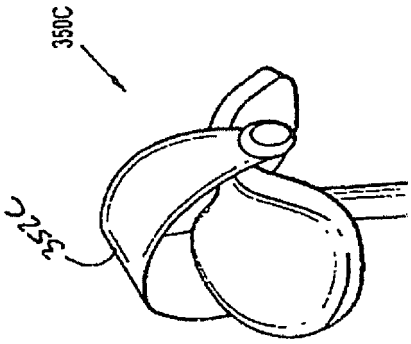

FIG. 21C

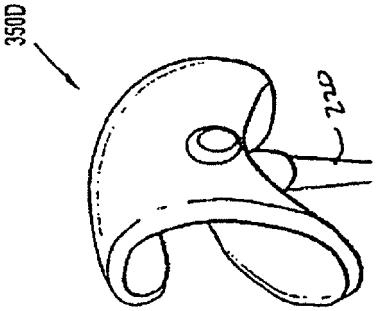

FIG. 21D

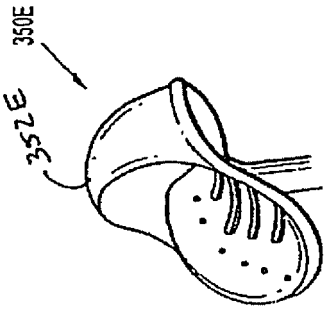

FIG. 21E

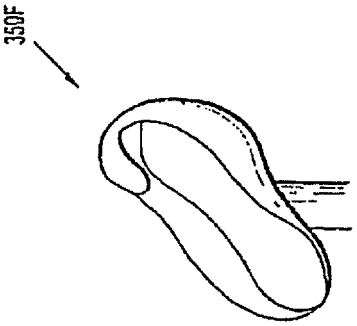

FIG. 21F

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 6666854 B **[0005]**
- US 20050273084 A **[0006]**
- WO 2008128236 A **[0007]**